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ABSTRACT

These eight papers on guidelines and standards for learning resources programs at the college and university level address such topics as technological communications services, instructional development, diffusion/adoption, production, telecommunication, utilization, facilities, and budgeting for learning resources programs. Many charts supplement the discussions. Among the more technical information provided by the document are a listing of major equipment needed to meet estimated minimum needs for mechanical preparation and creative production activities and a detailed table of space allocation for a library communications center. (JD)

COLLEGE LEARNING RESOURCES PROGRAMS: A BOOK OF READINGS

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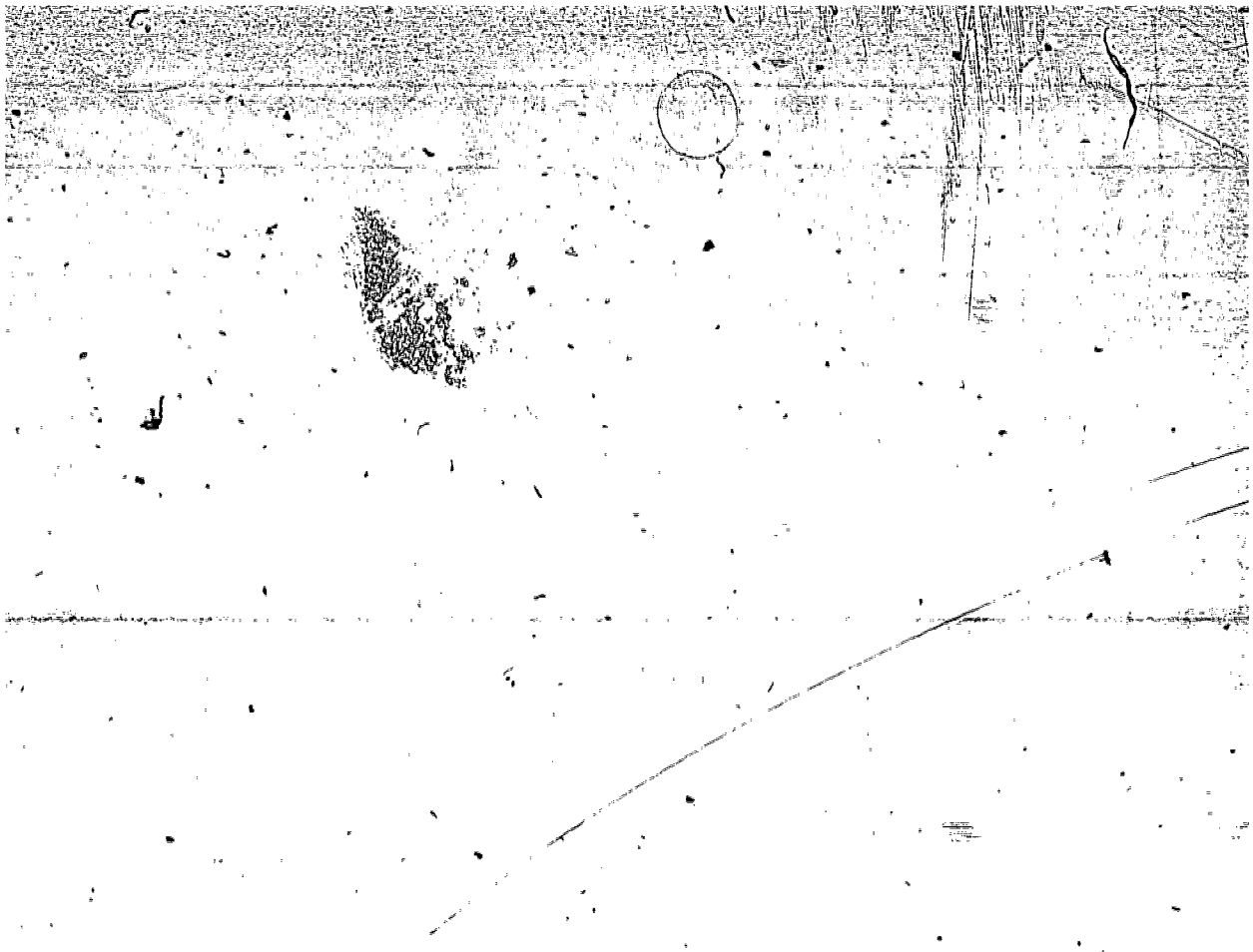

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TABLE OF CONTENTS

Foreword

Six years ago then President Robert Gerletti established a large task force of professionals within AECT charged for developing program standards for formal educational programs at all levels. That task force divided itself four ways and ultimately produced two sets of guidelines: (1) for educational communications and technology programs at the elementary and secondary level, and (2) for two-year post secondary institutions. The elementary and secondary programs guidelines document was developed jointly with the American Association of School Librarians and is a major revision of a 1969 document with the new title "Media Programs: District and School". The guidelines for two year post-secondary institutions were developed jointly with the American Association of Community and Junior Colleges and the Association of College Research Libraries and is entitled "Guidelines for Two-Year College Learning Resources Programs".

The subgroup of the Standards Committee which addressed the development of Guidelines for Learning Resources Programs for Colleges and Universities knew at the outset that they had a very difficult job. The fact that this document is being published six years later attests to the difficulty of the task.

Everyone who was involved in this work is dissatisfied with the current book of readings. There are two difficulties with this book: that the areas which are discussed do not constitute the universe of concerns with learning resources programs at the college level, and that the areas which are discussed are not addressed from a common framework (such as the domain of educational technology or some other paradigm). In spite of these shortcommings, the need in our field is so great for some professional advice concerning college and university level programs that the Board of Directors and members of the current committee feel the results should be published in this form at this time.

This work has proceeded under the regimes of seven AECT Presidents: Robert Gerletti, Robert Heinich, Jerrold Kemp, Robert Jarecke, Gerald Torkelson, Harold Hill and Richard Gilkey. The original chairperson of the Program Standards Committee of AECT was John Dome, and the two successive chairpersons of this College Guidelines Task Force were Gaylen Kelley and David Crossman. Besides the contributing authors to this volume, the following committee members donated their efforts during this period: Franz Frederick, Fred Harcleroad, and William Fulton. The Association is grateful to the efforts of all of the aforementioned individuals, but most particularly to the authors whose work made this publication possible.

Howard B. Hitchens
Executive Director

Technological Communications Services in Higher Education

JAMES W. BROWN, San Jose State University

INTRODUCTION

Recent changes in higher education in the United States suggest the need to reexamine some long-held but largely untested assumptions. These changes have to do with: (1) the numbers and variabilities of individuals seeking higher education today; (2) the continuing traditional character of college teaching, which has often failed to adapt to changing needs; (3) the nature of several new demands now placed upon higher education—such as demands for expanding continuing education and for offering external degrees; and (4) the opinions of legislators and taxpayers concerned with the financial support of higher education who question the efficiency of the present system.

There is no doubt that college and university enrollments are increasing. At the turn of the century, only 115,000 students (of the country's million people) were enrolled in institutions of higher learning in the United States. By 1970, this figure increased to 7.4 million (of a total population of about 200 million). The confident prediction for 1980 is that more than 11 million will be enrolled in college. Clearly, unless the current motivations of college-age students and their parents change radically, these enrollments will continue to grow for some time.

Enrollment of growing numbers of ethnic minority and economically disadvantaged students has increased the variability of motivations among today's college population. No longer is a college education the almost exclusive property of economically and ethnically favored groups. Other types of students, most of them motivated by a desire for upward economic mobility and security, attend college in increasing numbers. There is considerable impatience among these newcomers with taking "useless" courses that fail to match their vocational goals. No longer are students generally content to accept, without question, the irrelevant or the unreasonable. They are far less reluctant than formerly to insist upon participating in making instructional decisions, such as those pertaining to the ends and means of education, alteration of systems governing the awarding of credits and grades or alternatives about required attendance and independent study. College instructors, who have long been oriented toward the unilateral unquestioned imposition of learning tasks, experience unfamiliar (often public) criticisms of and pressures to change their approaches. Nearly every aspect of college teaching is open to such examination.

The aptitude of students now enrolling in colleges and universities is similarly varied. This variation is revealed both in the differences in the distribution of aptitude scores among different types of institutions and in the course structures these institutions offer. Professors whose past experiences have been limited largely to instructing students of high verbal ability find new problems in communicating abstractions to students who lack this ability. They find it difficult to capitalize on the different (but valuable) skills and insights

born of the firsthand experiences and cultural contacts of these minority and disadvantaged students—experiences and contacts which have unmistakable value for careers they have chosen.

On the other hand, taxpayers, legislators and boards of trustees question the input-output efficiencies of higher education and sometimes insist on accountability in the expenditure of funds supporting institutions. To them, the significant problem seems likely to remain what it has always been: how to support higher education. It seems likely that whether or not professors and administrators agree, much more effort than formerly will be given to seeking evidence of *efficiency* in the use of resources to achieve maximum increment in educational product.

Reconciliation of these differing requirements and expectations of professors, students and taxpayers with regard to higher education clearly calls for innovation. Efforts to provide professors with the tools and resources they need to teach and the time they need to change their approaches, to give the students the relevancy and freedom they seek to manage aspects of their own learning and at the same time to satisfy the input-output economic efficiencies sought by taxpayers and legislators suggest the applicability of the systematic approach of "instructional technology" as a solution to some of the problems of higher education.

What are the elements of this approach? In its simplest form, instructional technology involves the systematic interrelating of: (1) instructional goals, or purposes; (2) the status, capabilities, goals and needs of students participating in the system; (3) the status and capabilities of human resources—the professors and other professional, paraprofessional or the technical staff associated with teaching; (4) the status and capabilities of applicable non-human resources—the educational "software" or learning resources collections, instructional equipment, libraries, classrooms and laboratories, learning resource centers—of the institution; (5) the instructional management of the system which derives its clues for change and improvement from cybernetic feedbacks of a scientific evaluation of all aspects of the program.

The system of instructional technology envisioned in the guidelines that follow illustrates a program in support of college and university teaching and learning that attends to each of the foregoing elements through: (1) moving from vagueness as to purposes of instruction toward clear and precise statements of objectives reflecting intended behavioral changes of students; (2) identifying and adapting to the special characteristics of students participating in the instructional system to free them from lockstep requirements and permit more individualization and independence in studies and tailoring learning programs to their individual learning styles and capabilities; (3) identifying the particular strengths and interests of professors, educational specialists (including instructional technologists), paraprofessionals, technicians and others who may form team combinations or otherwise be used in carrying out various instructional assignments; (4) inventorying, classifying and increasing access to institutional resources required to support learning/teaching—some requiring and some not requiring human intervention; and (5) managing the instructional system to insure supportive, corrective and more efficient applications of effort and resources to achieve objectives and improve educational products of the system.

Instructional technology is thus of direct concern to higher education. The resources and services it contributes are *integral*, not peripheral, to conducting systematic teaching and learning. Instructional technologists must act on the understanding that the programs they provide assist in achieving instructional objectives. Therefore, their resource collections cannot remain as inert repositories of information waiting to be called into service; they must be used actively as significant elements of the instructional program. Instructional technologists and their staffs provide an essential interface between instructional resources and resource services and the teaching and learning requirements of professors and students.

GENERAL GUIDELINES FOR LRC's

Learning Resources Centers*

Professors, students and others who participate in the systematic approach to teaching and learning in higher education are given convenient access to a full range of learning resources' services, equipment and facilities. Included among the recommended learning resource centers for colleges and universities are: (1) libraries, (2) museums, (3) technological communications services, (4) computer services and (5) the press.

Administrative Relationships of Learning Resources Centers

All five of the foregoing resources centers appear in our recommended organization plan (see Fig. 1). They are coordinated at a dean's or vice-president's level within the functional responsibility for Learning Resources and Services for the entire institution. (Other terms are often used to designate the program center; at this writing, state and local conditions often mandate the term used.) Placement of responsibility at this high level insures proper orientation of the several services to serve the needs of and to provide leadership with respect to instruction, assure the elimination of undesirable duplications of some services and guard against the neglect of others.

Several guidelines apply to the work of the Learning Resources Centers: (1) each provides essential program design, resource selection, production, utilization and related technical services appropriate to its stated purposes; (2) each is oriented toward the improvement of teaching and learning within the institution; (3) responsibilities and functions of each center are clearly defined and available in writing; (4) policy coordination of the work of each center is achieved through appointment of a central advisory committee of faculty, students and administrators whose recommendations are made to the Dean of Learning Resources and Services or other responsible administrator.

TECHNOLOGICAL COMMUNICATIONS SERVICES: MANAGEMENT FUNCTION

Colleges and universities are urged to provide as one of their Learning Resources Centers a Technological Communications Services unit (see Fig. 1) that has as its principal responsibilities performance of:

- Instructional Development Functions
- Production Support Functions
- Utilization Support Functions

Further details of the nature of these three functions, as well as recommended guidelines for establishing and administering them, will be provided in later sections.

Management of the Technological Communications Services organization requires attention to long and short-range planning, budgeting, implementation, and evaluation and refinement of programs to meet changing requirements.

Planning and Budgeting Guidelines

Planning and budgeting for the program of the Technological Communications Services organization should recognize other plans that are also to be developed for other Learning Resources Centers (libraries, museums, computer services, the press or others) and should be closely integrated with and supportive of institutional, school or college, and departmental curricular objectives and purposes.

These activities should involve, in appropriate ways, all who will be affected by them: the TCS director, his professional staff members and support personnel, as well as representative faculty and student users of the service. They should take into account the current

*Center, in this usage, refers not to a physical facility, but to a program or cluster of programs. The usage of the term is similar to that in "cost center."

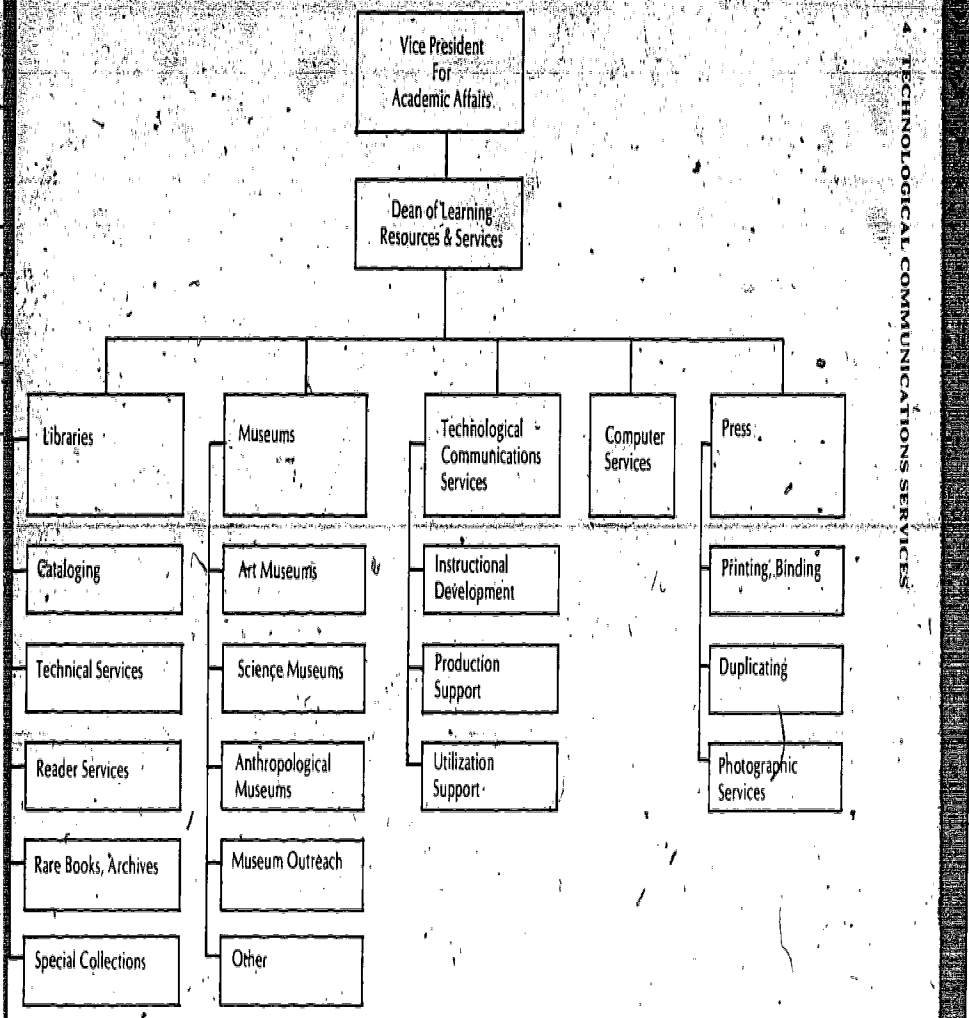


Figure 1. Sample Organization of Instructional Resources and Services

status of the total TCS program, as well as those elements that should be continued, those that should be restricted or discontinued, those that should be expanded and those that should be introduced. New elements should be described in "proposal" form and should be accompanied by statements of purposes to be served and objectives to be reached within certain time frames and at certain quality levels. Criteria by which to judge achievement of objectives should also be supplied.

Expenditures of budgets should permit substitutions and reallocations of items as necessary to support justifiable program changes, provided total expenditures remain within predetermined limits.

Implementing the TCS Program

The TCS director should be responsible, within limitations of applicable policies and lines of authority, for performing the duties and functions assigned to him. Internal administration of the TCS should involve staff participation.

Appropriate statistical data should be gathered concerning the implementation of the TCS program to provide corrective or reinforcing feedback on its operations. Information concerning the purposes, accomplishments and needs of the TCS program should be shared through newsletters, information meetings or other means, with individuals interested in its operation.

Evaluating and Refining the TCS Program

Costs of various subprograms within the operation of the TCS should be monitored and evaluated as to their "cost-effectiveness." Continuous effort should be made to determine the suitability (validity) of program objectives, the degree of their achievement and the need for corrective action to insure coordination of those objectives and the capability of the TCS unit to achieve them.

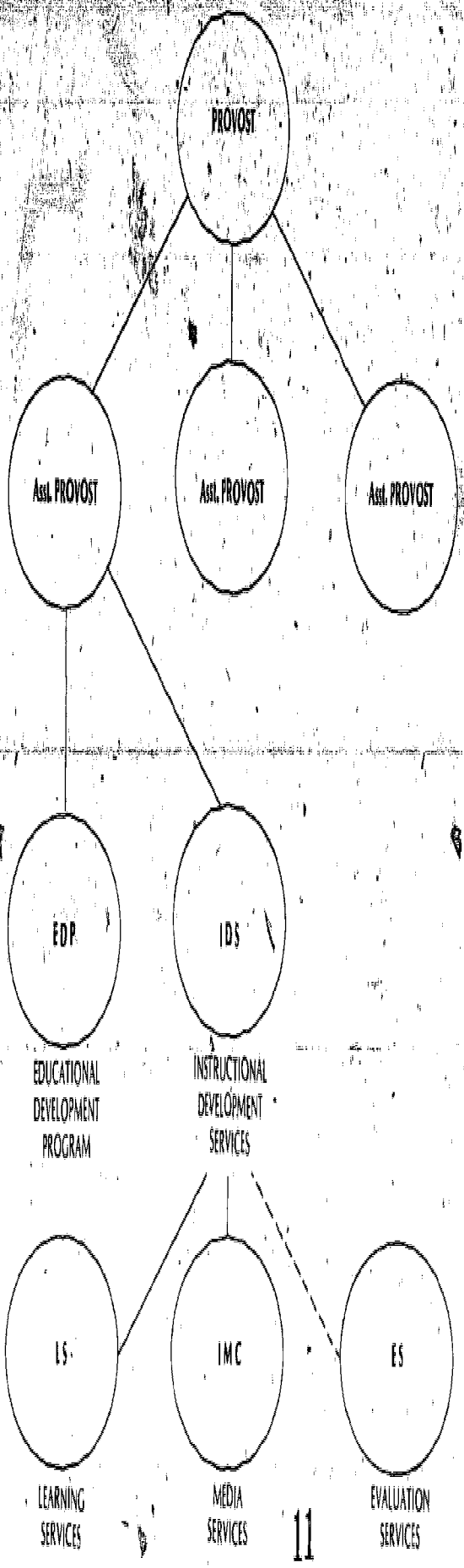

PROVOST
Asst. PROVOST
Asst. PROVOST
Asst. PROVOST
EDP
IDS
EDUCATIONAL DEVELOPMENT PROGRAM
INSTRUCTIONAL DEVELOPMENT SERVICES
LS
IMC
ES
LEARNING SERVICES
MEDIA SERVICES
EVALUATION SERVICES

Figure 2a

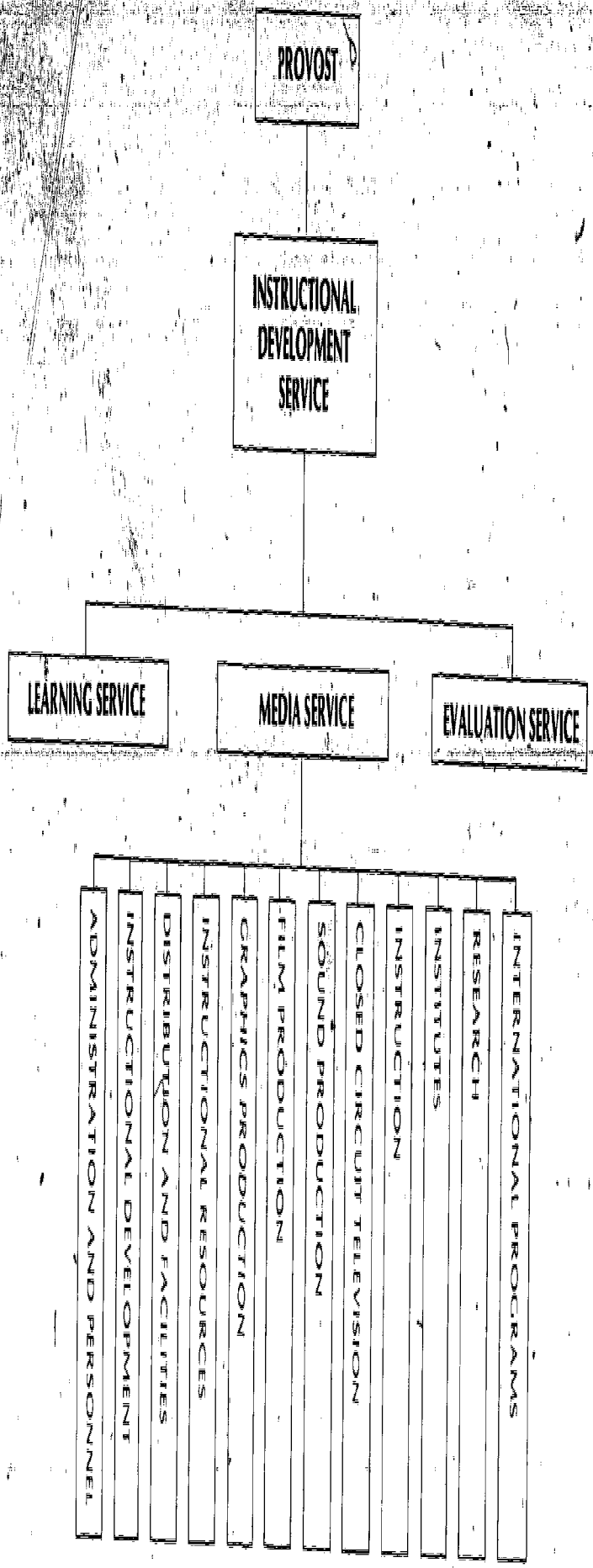

PROVOST
INSTRUCTIONAL DEVELOPMENT SERVICE
LEARNING SERVICE
MEDIA SERVICE
EVALUATION SERVICE
ADMINISTRATION AND PERSONNEL
INSTRUCTIONAL DEVELOPMENT
DISTRIBUTION AND FACILITIES
INSTRUCTIONAL RESOURCES
GRAPHICS PRODUCTION
FILM PRODUCTION
SOUND PRODUCTION
CLOSED CIRCUIT TELEVISION
INSTRUCTION
INSTITUTES
RESEARCH
INTERNATIONAL PROGRAMS

Figure 1

UNIVERSITY DIVISION OF INSTRUCTIONAL SERVICES

Figure 2

TABLE OF ORGANIZATION

Figure 3

CRITERIA FOR PLANNING THE UNIVERSITY RESOURCES CENTER

UNIVERSITY OF CALIFORNIA SYSTEM

Figure 4

FLORIDA STATE UNIVERSITY

Three other important themes can be observed in the literature on development. The

The utility of such a scheme is evident when the
to process Ma
for continued
placed

Personnel Specifics

Supplies and Expenses

Paper and

Output

The Diffusion/Adoption Function

ALICE AWADALLA, INDIANA UNIVERSITY

RATIONALE

Personnel and Competencies

- Selecting the most effective dissemination vehicles to convey information to specific audiences.
- Composing the information within a chosen format for accurate and pervasive dissemination
- Implementing actual dissemination, including the distribution of technical production per-

The budget should be adequate to cover the following categories of expenses

Personnel Salaries of professional diffusion specialists assistants and other support personnel (office

Travel Transportation expenses Diffusion

Materials

The Production Function

DAVID H. CURL, Western Michigan University

INTRODUCTION

Many necessary instructional materials are not available in usable form from commercial sources, so they must be produced or adapted locally. To meet this need, technical personnel of the college or university media center work in consultation with clients and with instructional development staff to produce media that have been requested directly by official users, or media for which the nature and need have been determined by a systematic process of instructional development.

Media production facilities and services in higher education primarily serve four groups of clients: (1) faculty members—for classroom presentation or individualized instruction and in support of research and scholarly publication; (2) students—for course projects and extracurricular activities; (3) media center personnel—for faculty development workshops, inservice training and technical research; and (4) administrators, counselors and public relations staff—for presentations both on and off campus, i.e. budget, public information, recruiting and employee training. Despite the variety of users and uses, a survey of representative media production centers indicated that from 75% to 85% of the workload of the media production services unit was, and should be, attributable directly to support of instruction.[1]

Although the support and improvement of instruction is the main reason for providing media production services, the typical college or university professor has not often been a regular customer of the media center. When media production services have been used, the faculty member's needs have most often been satisfied at what Kemp[2] has described as the *mechanical preparation* level (Level 1). Included at this fundamental, or basic level are such functions as the routine mounting or laminating of pictures and charts, the duplicating of prepared handout materials by spirit, stencil or offset processes, or the copying "as is" of illustrations from books and other sources as slides and transparencies. In other words, the mechanical preparation level (Level 1) involves local production of audiovisual "aids" at the request of the user with no questions asked and little advice given. According to the survey mentioned above, approximately 75% to 90% of media production in higher education is presently at this level.[3]

Relatively few professors on the average campus request services at Kemp's definition of the *creative production* level (Level 2) at which tactical decisions are made by the producer, in consultation with the faculty user, about content, treatment and format of tailor-made media such as teaching displays, sound/slide series or instructional films or videocassettes. Consequently, most college and university media centers tend mainly to employ

[1] Unpublished survey by David H. Curl, 1972-74.

[2] Kemp, Jerrold E. Planning & Producing Audiovisual Materials, 2nd ed. Chandler Publishing Company, San Francisco, CA, 1968.

[3] Curl, op. cit.

students and technician-level production personnel in considerably greater numbers than media consultants with graduate degrees. Level 2 implies media planned and produced in units or modules to fit a professor's general objectives.

The stress of instructional development has shifted the focus from media as end products in themselves to media as a means toward achievement of specified performance objectives. Therefore, as the production function overlaps into the domains of development and diffusion/adoption (see Fig. 1, page 13, Instructional Development) production personnel and facilities must be sophisticated enough to support higher-level quality demands, increased workloads and prolonged professional responsibilities at Kemp's strategic, client- and objectives-centered *conceptual design* level (Level 3). This highest level can be expected to become the focus of media production activities in the decade to come. Level 3 is the level of full instructional development at which media are planned, produced, tested and carefully integrated into instructional programs based upon performance objectives.

Although routine "walk-in" graphic, audio, photographic and reproduction services must be maintained by the media center for users who will continue to require these services, the following guidelines and discussion are based upon the premise that the major orientation of the media production function in higher education should be toward achieving the capability to perform services at Level 3.

A HYPOTHETICAL MEDIA PRODUCTION CENTER

For purposes of this publication we shall consider the following areas of production: (1) administration and supervision, (2) audio production, (3) graphic production, (4) photography, both still and motion picture, and (5) printing and duplicating.

Survey data led to the development of the chart on the next page which indicates the relationships of these services to each other and to the total media center in a hypothetical organizational chart. According to the estimates of survey respondents, such an organization would be capable of providing media production services up to and including Level 3 for a college or university of approximately 10,000 Full Time Equivalent (FTE) enrollment.[1] Note that television, as a part of the telecommunications functions, is shown separately on the chart, precedent seeming to have established telecommunications in this way on many campuses. A unique area combining both production and distribution functions, telecommunications draws upon the combined talents of instructional development, production and utilization personnel. Motion picture production as well as some audio and graphic functions will be included within telecommunications at many institutions. Likewise, printing and duplicating services are often centralized in a print shop separate from media services. Our chart, however, reflects a concensus of needed production functions as well as a common organizational structure.

The survey included the editorial and programming areas, but in tabulating data from various colleges and universities it was difficult to separate editorial, scripting and program writing functions from instructional development functions. At institutions where an instructional development unit was not identified, personnel performing these functions were often housed within the production services unit. For purposes of present guidelines, writers, editors and programmers are classified as instructional developers and their activities do not appear under production services.

Personnel

Associate Director for Production Services

Nature of Work Serves as liaison between instructional developers and other users of production services and the technical personnel under his direction, responsible for the

[1] Cont. on p.

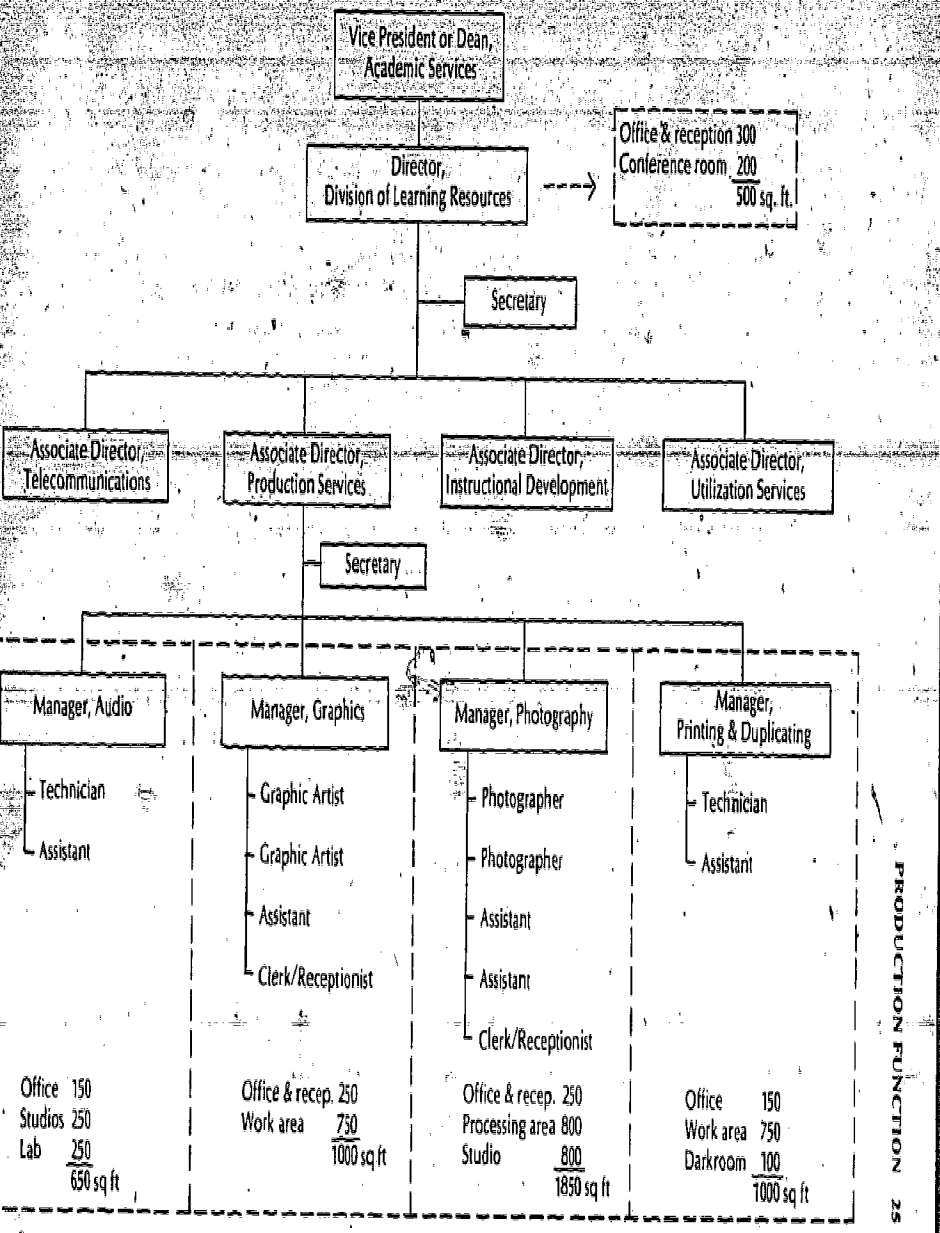


Figure 1

management and overall supervision of audio, graphic, photographic and reproduction services.

Examples of Work—Establishes production services goals, plans production schedules and monitors production activities; consults with faculty, instructional developers, and other users on the design, production and evaluation of instructional media; establishes and sustains quality control standards; maintains accurate records of departmental income and operating costs; specifies purchase and maintenance of major equipment; interviews, evaluates and provides training for production personnel; participates in the planning and presentation of courses, workshops and inservice programs for faculty and students.

Qualifications—Minimum of MA (doctorate preferred in larger universities) with teaching experience in higher education; experience in media production mandatory; technical expertise highly desirable.

Number of Positions—One per institution or campus. At colleges with enrollment less than 1,000 FTE, functions of this position may be combined with those of the Director of Instructional Communications.

Manager, Audio

Nature of Work—Consults with clients on audio and acoustical problems and supervises work of technical personnel.

Examples of Work—Provides professional consultation to faculty, students and other clients regarding audio presentations and acoustical treatment of facilities; coordinates and supervises the work of audio technicians and other personnel; trains audio personnel and evaluates their performance; maintains quality control standards; maintains stocks of supplies and recommends purchase of equipment and supplies; maintains production records; assists with courses, workshops and inservice programs for faculty and students; scripts, records, dubs, edits and mixes audio programs and operates equipment.

Qualifications—BA or MA with experience in electronics and commercial audio or broadcasting. Technical competence mandatory.

Number of Positions—One per institution or campus. At a college with enrollment of less than 1,000 FTE, this individual may be required to perform all technical functions and to supervise student assistants.

Audio Technician

Nature of Work—Prepares sound recordings for instruction and operates and maintains audio equipment; must be capable of working independently on assignments with only general supervision.

Examples of Work—Records narration, dialog and performances; edits, dubs and mixes audio tracks, makes tape duplicates for instruction; installs and maintains recording, public address and sound reinforcing systems; supervises work of student assistants.

Qualifications—BA desirable; electronics and audio experience mandatory.

Number of Positions—One per 10,000 FTE enrollment. Some duties may be shared with personnel in telecommunications area.

Manager, Graphics

Nature of Work—Consults with clients on graphic design and production and supervises work of technical personnel.

Examples of Work—Provides professional consultation concerning creative applications of graphic design for faculty, students and other clients on technical and esthetic problems relating to production of artwork for instruction, display and publication; prepares preliminary sketches, outlines and publication dummies; coordinates and supervises the work of

graphic artists, draftsmen and other personnel; trains graphics personnel and evaluates their performance; maintains quality control and esthetic standards; maintains stocks of supplies and recommends purchase of equipment and supplies; maintains production records; assists with courses, workshops and inservice programs for faculty and students; plans, designs and produces graphic materials.

Qualifications—BA, BFA, MA or MFA with experience in commercial art; must show evidence of competence in all aspects of graphic production.

Number of Positions—One per institution or campus. At a college with enrollment less than 1,000 FTE, this individual may be required to do mainly design and production work and to supervise student assistants.

Graphic Artist

Nature of Work—Prepares artwork for non-projected charts and displays and for transparencies, slides, filmstrips, motion picture titles and animation, and television graphics; must be capable of working independently on assignments with only general supervision.

Examples of Work—Works from sketches to render finished artwork for charts and displays and for projected media; prepares lettering for visual media; operates equipment such as typesetting and transparency making machines and vertical process camera; performs routine maintenance on equipment; supervises work of student assistants.

Qualifications—BA or BFA desirable; commercial art experience mandatory.

Number of Positions—One per 5,000 FTE enrollment. Additional artists or draftsmen will be required at institutions doing engineering drafting or a large volume of publications and publicity work.

Manager, Photography

Nature of Work—Consults with clients on photographic problems and supervises work of technical personnel.

Examples of Work—Provides professional consultation for faculty, students and other clients on solutions to technical and esthetic problems pertaining to still and motion picture photography; coordinates and supervises the work of photographers and other technicians; prepares storyboard and shooting script when not provided by client; trains photographic personnel and evaluates their performance; maintains quality control standards; requisitions supplies, laboratory services and equipment, maintains production records; develops accountability system and maintains security for facilities, equipment and supplies; assists with courses, workshops and inservice programs for faculty and students; performs any task assigned to a photographer or technician.

Qualifications—BA, BFA, MA or MFA with professional photographic experience; must show evidence of competence in all areas of photography.

Number of Positions—One per institution or campus. At a college with enrollment of less than 1,000 FTE, this individual may be required to perform all photographic assignments himself and to supervise student assistants.

Photographer

Nature of Work—Produces a wide variety of still photographs and short motion pictures largely for instructional purposes; must be capable of working independently on assignments with only general supervision.

Examples of Work—Photographs [illegible] prints, displays, buildings, scenes and other illustrative subject matter [illegible] black and white and color.

negatives; makes line and continuous-tone copies and macro photographs in black and white and color; operates 35mm, 2 1/4 and 4 x 5 still cameras and 16mm and super 8 motion picture cameras and accessories; processes and prints black and white and color roll and sheet films and produces black and white and color prints and slides; scripts, shoots, edits and assists with sound recording for instructional motion pictures and film segments, slide/tape programs, filmstrips and multi-image productions; performs routine maintenance of equipment; supervises work of student assistants.

Qualifications—BA or BFA desirable; varied professional photographic experience mandatory.

Number of Positions—One per 5,000 FTE enrollment. Additional photographers or technicians will be required at institutions requiring specialized photographic services such as photomicrography, photo-instrumentation and when public relations photography, portraits and identification pictures and athletic films are produced in the media services unit. Some large universities having a separate film production unit may include instructional motion pictures and television film as responsibilities of that department.

Manager, Printing and Duplicating

Nature of Work—Consults with clients on printing and duplicating needs related to instruction; supervises work of technical personnel.

Examples of Work—Provides professional consultation to faculty, students and other clients concerning appropriate reproduction processes; coordinates and supervises the work of duplicator operators and other technical personnel; trains personnel and evaluates their performance; maintains quality control standards; maintains stocks of supplies and recommends purchase of equipment and supplies; maintains production records; assists with courses, workshops and inservice programs for faculty and students; operates equipment to meet all duplicating and reproduction requirements.

Qualifications—BA desirable; technical experience in commerical duplicating and printing mandatory.

Number of Positions—One per institution or campus. At a college with enrollment of less than 1,000 FTE, this individual may be required to perform all technical functions and to supervise student assistants. (This position may not exist within some universities having established printing departments. Where a strong centralized printing facility exists, the supervisor of graphics will probably be the liaison person responsible for carrying through on reproduction projects. In such cases the Division of Technological Communications may not include a printing and duplicating function.)

Printing and Duplicating Technician

Nature of Work—Produces finished booklets, brochures, handout sheets etc. from copy prepared by graphic and photographic personnel and clients.

Examples of Work—Prepares line and halftone negatives from camera-ready copy, makes plates for offset printing, operates offset duplicators and presses, collates, trims, stitches and or ring binds finished materials, performs routine maintenance on equipment, supervises work of student assistants.

Qualifications—Vocational training and experience mandatory.

Number of Positions—One per 10,000 FTE enrollment. Additional technicians will be needed at institutions not providing general printing services. At some institutions all printing and duplicating will be done by the centralized printing department. [illegible] services need not be provided by the Division of Instructional Communications.

Summary

Figure 1 provides a model media production services organization that can be expanded or reduced according to the size and special requirements of each college or university. The suggested job descriptions are representative of actual positions found at the institutions surveyed and space recommendations are indicative of what should be considered the minimum amount of space needed to serve a small to medium sized campus.

PRODUCTION POLICIES

In conclusion, it seems appropriate to review some areas of production policy that have frequently caused confusion and conflict on campuses.

Copyright

In local reproduction of materials for instructional or other public use, care should be taken to secure permission in accordance with copyright regulations.

Proprietary Rights

It is ordinarily assumed that all rights to materials produced by a faculty member or employee as a part of his regular job belong to the institution, unless contracted otherwise. Likewise, it may be expected that rights belong to the individual employee when materials are produced on his own time and without the use of materials, equipment or facilities belonging to the institution. It is important, however, that policies be established by which specific cases may be judged.

Residual Rights

Policies should be determined to protect the rights of faculty and staff members when locally produced materials they have produced, authored or participated in are published or used beyond the purpose for which they were originally intended. The individuals affected should participate in decisions regarding such additional uses and agreement should be reached regarding royalties or other compensation.

Teaching vs. Production

Efficiency and quality demand full-time professional producers, photographers, graphic artists and technicians; but when teaching is also involved, conflicts of interest can arise. When an individual reports to more than one supervisor and is expected to allocate his time equitably between different spheres of responsibility, the quality of either the teaching or the production has been known to deteriorate. Definite policy guidelines are important in such cases, especially when individuals hold dual academic and technical or administrative appointments.

Student Help

Students can learn a great deal by working in the media production center - this is, in fact, the way most professionals in the field got their start. But because of the high turnover each year, students require considerably more time to train than permanent personnel. A good rule is to employ a full-time cadre of professionals in key positions, then supplement the work of these key individuals by assigning students initially to jobs requiring a minimum of experience. The more able students may then be rotated into more responsible jobs as they return in subsequent years.

Charging for Services

Some institutions underwrite budgetary support to the media center so that all production services for instructional and related purposes can be provided free of charge. Other

media centers are forced to charge individual users or users' departmental budgets either a fixed "catalog" price or to invoice for time and materials or for materials only. Differential rates are often established, charging less for materials to be used for instruction and more for materials intended for other purposes. Free services encourage the use of media, of course, and reduce the amount of bookkeeping and billing required of the media center. Regardless of institutional requirements, charging and billing policies should be established, published and uniformly adhered to.

Research and Publication

Policies should be established to determine whether or not materials will be produced or duplicated by the media center for individuals, i.e. students working on theses or class projects or faculty members documenting research projects or preparing manuscripts for outside publication. If such work is done, it must be determined whether full charges will be assessed or whether the individual pays only for expendable materials consumed.

Do-It-Yourself

Teaching basic production skills to faculty members, students and employees of other departments encourages them to make and use more audiovisual materials. But at the same time, instruction and consulting advice encourage other departments to establish their own media production facilities that often duplicate those of the media center. High-level policy decisions are necessary on the question of centralization vs. decentralization of production facilities, equipment and personnel. Perhaps an ideal compromise reached on some campuses is to establish centralized control of media production, including purchasing of equipment and supplies, while providing satellite centers in key areas on campus to serve clients most conveniently.

Personal Work

A frequently stated policy is that employees of the media center may use institutional equipment and facilities after work hours for personal production work of a non-commercial nature. Wedding photographs or portraits for sale would be prohibited, for example, but photographs for exhibition in an art show would be permitted—even encouraged—as evidence of professional growth of the individual. Specific policies should be formulated to cover production of items that may compete with private industry such as political campaign posters and literature, church programs, club newsletters and personnel stationery and greeting cards. If such projects are allowed, in no case should expendable materials be used that have not been supplied or reimbursed by the individuals concerned.

CAPITAL EQUIPMENT

Our survey of college and university media production centers revealed the following items as representative of major equipment needed to meet estimated minimum needs at levels 2 and 3. Certain items will not be required at all centers; for instance on campuses where all printing is centrally done, none of the printing and duplicating equipment listed will be applicable to the media services center. Motion picture production equipment may not be needed at institutions served by a separate telecommunications facility. Only the largest—or most remote campuses will be able to justify the expense of purchasing and maintaining automatic continuous photographic processing machines; but in cases where the workload requires, such equipment is desirable indeed.

In many instances, at least one of a given item will be required to meet minimum service needs, regardless of the size of the institution. From an analysis of equipment owned

by existing media production centers we have attempted to provide quantification guidelines that will provide an intelligent departure point for estimating the needs of a given college or campus. Note that these items are housed and used in the media production center. This list does not include equipment housed in the general equipment pool and available for use by other departments and by students as part of regular classroom instruction.

Items	*Quantity*
Airbrush and compressor	1 per institution or campus
Binding machine, plastic ring	1 per institution or campus
Camera, animation—slide, filmstrip and motion picture	1 per institution or campus
Camera, 35mm single-lens reflex	1 per photographer + 2 spares
Camera, 35mm half-frame filmstrip	1 per institution or campus
Camera, 2 1/4 reflex	1 per photographer
Camera, 4x5 view	1 per institution or campus
Camera, photostat	1 per institution or campus
Camera, Polaroid	2 per institution or campus
Camera, copy, Polaroid and 4x5	1 per institution or campus
Camera, process copy, up to 11x14	1 per institution or campus
Camera, motion picture, super 8	2 per institution or campus
Camera, motion picture, 16mm silent	1 per institution or campus
Camera, motion picture, 16mm sound	1 per institution or campus
Coater, wax	1 per institution or campus
Collator	1 per institution or campus
Composer, type, photo/optical	1 per institution or campus
Console, mixing, audio studio	1 per 10,000 FTE
Copier, office type	1 per 5,000 FTE
Dissolve unit, 2x2 slide projector	3 per 10,000 FTE
Duplicator, cassette tape	1 per 10,000 FTE
Duplicator slave, cassette tape	1 per 2,000 FTE
Duplicator, 1/4" tape	1 per institution or campus
Duplicator, offset, up to 11 x 17	1 per 5,000 FTE
Duplicator, electrostatic (Xerox)	1 per 10,000 FTE
Duplicator, mimeograph stencil	1 per 10,000 FTE
Duplicator, spirit master	1 per 10,000 FTE
Duplicator, slide and filmstrip	1 per 10,000 FTE
Drill, paper	1 per institution or campus
Dryer, continuous, photo print	1 per institution or campus
Editor, motion picture, super 8	1 per 10,000 FTE
Editor, motion picture, 16mm silent	1 per institution or campus
Editor, motion picture, 16mm sound	1 per institution or campus
Enlarger, photo, up to 2 1/4	1 per photographer
Enlarger, photo, color head 4 x 5	1 per institution or campus
Jogger	1 per institution or campus
Laminator, continuous roll	1 per institution or campus
Lights, photo studio	12 per 10,000 FTE
Microphone, studio	5 per 5,000 FTE
Mixer, audio, portable	1 per 5,000 FTE
Mounter cutter, 35mm slide	1 per institution or campus
Platemaker, offset, automatic	1 per institution or campus

Press, dry mounting	2 per 10,000 FTE
Press, printing, proof and sign	1 per institution or campus
Press, titling, "hot" type	1 per institution or campus (optional)
Processor, continuous, b & w roll film	1 per institution or campus (optional)
Processor, continuous, color roll film	1 per institution or campus (optional)
Processor, continuous, color print	1 per institution or campus (optional)
Processor, continuous, motion picture film	1 per institution or campus (optional)
Processor, drum, color print	1 per institution or campus
Processor, stabilization, b & w print	1 per institution or campus
Projector, motion picture, super 8 mag. sound	1 per institution or campus
Projector, motion picture, 16mm optical/ mag. sd.	1 per institution or campus
Projector, motion picture, 16mm, interlock	1 per institution or campus (optional)
Projector, opaque, enlarging/reducing	1 per institution or campus
Projector, overhead transparency	1 per institution or campus
Projector, filmstrip	1 per institution or campus
Projector, automatic, 2x2 slide	8 per 10,000 FTE
Programmer, multi-channel, 2x2 slide	1 per 10,000 FTE
Punch, cel, animation	1 per institution or campus
Punch, binding, plastic ring	1 per institution or campus
Recorder, audio cassette	1 per 5,000 FTE
Recorder, audio cassette synchronizer	1 per 5,000 FTE
Recorder, audio, 1/4" tape, studio master	2 per 10,000 FTE
Recorder, audio, 1/4" tape, portable	1 per 5,000 FTE
Recorder, audio, 1/4" tape, magnetic synch.	1 per institution or campus (optional)
Recorder, magnetic film, 16mm, synch.	1 per institution or campus (optional)
Saw, table or radial arm	1 per institution or campus
Saw, jig	1 per institution or campus
Stand, copy, still photo and super 8	1 per 10,000 FTE
Speaker, monitor, studio	4 per 10,000 FTE
Stitcher	1 per institution or campus
Sign-maker, embossed letter	1 per institution or campus
Table, illuminated, viewing and stripping	1 per 5,000 FTE
Table, drafting	1 per graphic artist
Transparency maker, thermographic	1 per 10,000 FTE
Transparency maker, diazo	1 per 10,000 FTE
Trimmer, paper, guillotine	1 per institution or campus
Typewriter, electric, office	1 per office
Typewriter, large-type	1 per 10,000 FTE
Washer, photo print, to 20 x 24	1 per institution or campus

The Telecommunication Function

CHARLES NELSON, Southern Illinois University

INTRODUCTION

Communication is a major process in education and social interaction. This process is a circular, ongoing transference of messages between sources. The experience of the sender and the receiver affects the shape and meaning of the message. What a communicator brings to the situation from past experience determines to a large degree the effectiveness of the communication. There must be some congruency of experience between the sender and the receiver or the message will get through but the meaning will not. The shape of the message is couched in a mixture of three domains: the cognitive (intellectual), the affective (emotional) and the psychomotor (physical).

Whenever message transmission is conducted, all domains of learning are present at some level. A television lecture may have current and precise information and yet the meaning of the message will be blocked because only the intellectual aspect is taken into consideration while emotional and physical aspects of production are ignored.

The transference of meaning is limited by the senses. We cannot read people's minds; we can only shape meaning within the constraints of the senses. Sensory and perceptual aspects, which have received much study, are also considerations which need further research, particularly in terms of the communications process as it relates to television.

A bi-sensory channel for communications as well as a practical medium for learning, television remains viable, having much potential, and should be a highly prized resource. The use and misuse of television have left a wide variety of attitudes concerning its place in education. Its technological compatibility, expense, the need for trained specialists and the all-consuming production capacity make this medium a difficult one. Technical, electronic problems in television are probably the easiest to work out. A wide variety of equipment is now available in both black-and-white and color, ranging from inexpensive equipment available for the novice through various levels of sophistication to professional equipment requiring trained technical personnel.

A commitment to producing television programs on a campus means there must be enough resources available to consistently do an adequate job. The medium of television can be considered a monster which is constantly consuming ideas, talent and materials. Once each production is completed, all the resources are scrapped and another production must be assembled. Until the present easy access to video tapes, each production was presented and then it was over. The total production existed for a moment and then was gone, making every production ephemeral, unlike hard copy which one can review, study, compare, skim and ponder. With videotape, a more permanent product is possible in terms of having the production accessible to faculty and students. This helps alleviate the problem of the all-consuming monster to some extent, but the possibility of storage and retrieval of successful productions should be explored. Depositories for videotapes are being implemented both on campuses and regionally, but not to the extent that films are now available. The transfer of

videotapes to film is a possibility itself for effective and easy handling, but even so, the establishment of depositories, using good storage and retrieval, will help conserve production resources.

Educational television and instructional television have great potential. Educational television—the programming of materials for the generalized public of all ages—is found mostly in broadcast television. Lately it has expanded through cable television and videotapes available through public libraries. Considerable expansion is still possible. With the development of community antenna systems and closed-circuit networks, more channels are available for home viewers to select as prime vehicles for educational television.

Instructional television—that programming which is designed with specific objectives for particular populations—is moving more towards closed-circuit and portable television. All too often, instructional television has been used for promoting and preserving lectures. This style of production has been deadening to the status of instructional television. Students cannot accept such programming.

Due to the learning characteristics of students and the complexity involved in good communications, as well as the slick productions available on commercial television, instructional television must be produced in ways more appropriate to the medium of television (the talking face is out!). If instructional television is to be used to its best advantages, then the visual work must be produced with a high percentage of images that have a message. Many graphics and a wide variety of visuals are needed in any instructional television production. The visual image must either support the verbal material or be so specific that the meaning in the message is evident when viewed.

Learners of our contemporary age are sophisticated television viewers and, thus, expect such aspects of television as: variety that does not lose consistency; action which avoids busy sequences; the use of color; shots which have been established with much close work; short, concise presentations; humor which avoids the ridiculous, and the personal approach. Learners will accept some poor technical qualities if the production quality contains these aspects. Learning is best facilitated when it is specific to the point of requiring active involvement resulting from the presentation. Instructional television can be motivating at the affective level.

PROBLEM AREAS

Some material is not appropriate for television. For example, television is a poor medium for conveying the printed word. It is very difficult to see sentences and paragraphs on television; only phrases and titles work well. When charts, maps and graphs are used, an overall view of the material does not convey the message clearly. The meaning can be better derived by focusing the viewer's attention on that particular portion of the visual the instructor is highlighting. Productions are moving more toward tight, close shots that afford more efficient study of materials.

Since the verbal material in the audio portion is usually needed to convey much of the cognitive material, the sound production needs to be given precise attention. All too often in portable television work in the classroom the microphone picks up reverberated sounds rather than direct sound from the source. The difficulty in understanding the playback form is extreme. Closer placement of microphones and the use of directional microphones need to be encouraged. Often one needs to correct the problem only by using an extension cord. In studio work it is usually corrected by using a lavalier microphone.

STUDIO TELEVISION

Studio television is advantageous for campuses for several reasons:

- While the on-campus, closed-circuit system is the most difficult area to deal with for instruction, other applications can be managed through the closed-circuit system, such

as in-service work for faculty, sports events, testing, and special events, including graduation, convocations and public addresses.

- A second function of a studio facility is the production of videotapes, such as tapes for portable classroom equipment and other studio playback facilities. These tapes are produced as a service to faculty and are often produced in cooperation with faculty members. Studio-produced tapes can be used at the convenience of each faculty member and the material on the tape can be more closely designed to accommodate specific needs.
- Studio productions are usually slicker than portable productions. Multiple cameras with their various advantages of superimposition, split screens and other special effects can be highly-utilized. Tighter, better focused shots can be obtained.

Studio production is more impersonal than portable classroom production, since classes or audiences are usually not available. To compensate for this, there has been a trend toward requiring on-time or off-time student involvement in activities related to the program. It is difficult to find personalities who can successfully handle this type of environment. Studio talent need to have knowledge of their subject and of teaching, as well as that personal quality which is captivating to the audience.

Studio television, both broadcast and closed-circuit, can range widely in complexity, from one professional using student operators, to complete facilities and a staff of administrators, engineers, production workers and on-camera personnel. Established controlled viewing areas and equipment which is permanently set and which usually has the capabilities of doing something more than a single camera and video recorder can are indicative of studio television. Lighting and sound capabilities are usually better controlled. Multiple camera hook-ups are installed. Some cameras are controlled remotely from a console and others are operated by camera personnel.

PERSONNEL

The professional staff of a studio should include people with training and experience in administration, electronics, television production and teaching. Small facilities will need to employ persons with two or more of these talents in order to produce quality programs within their budget.

Administration

Administration requires knowledge of budget planning, public relations, overseeing of personnel and general knowledge of educational processes. The administrator needs to be given a prominent position, so as not to be swayed or pressured by any one person or group. In some cases this will require his being placed with the vice-president and in others it will require placement with a strong media director. Administrative freedom is needed so that the administrator will not get caught up in serving a few needs on campus to the exclusion of others.

Technical

Technical personnel are needed for the smooth operation and maintenance of equipment. In sophisticated systems people with engineering licenses are needed. With less sophisticated systems, a technical worker should have sufficient training in preventive maintenance in order to troubleshoot problems with equipment before complete breakdowns occur. He should have access to and be able to use several pieces of test equipment. A moderate amount of benchwork should be part of this training. This person should be able to adapt to changing equipment and facilities. He should be versatile in order to obtain the best possible quality control on the final product, while being able to work with facilities which might be considered inadequate.

Production

Production personnel must be proficient in grades, staging, sound and acoustics, lighting, photography, camera operations and the use of make-shift props. They need to be creative and inventive and able to perceive the product desired by the instructor or director who is organizing the production. In all cases personnel with teaching experience or training can be of great help in producing effective instructional television.

Talent

Talent for studio television must have knowledge of the subject, rapport with the viewers and flexibility. Knowing one's subject insures confident presentations, both verbally and visually. The best visuals can then be chosen in terms of the meaning which is to be conveyed. Together, the television staff and performers can design the most creative approaches and combinations for the visuals.

Rapport between the talent and the viewers is accomplished through previous contacts, plain talking during the presentation and the use of humor. If these three factors are positive, the chances of relating to the viewers can be increased.

Because television is a one-way device for communications, establishing rapport is not as easy as in a two-way interchange. Assessing the effectiveness of the presentation is a delayed function requiring many hours or days. It is difficult to have good presentations with performers who do not project well on television. However, it is difficult to detect good or bad talent on camera until auditions have taken place or until several presentations have been viewed. An unresolved problem is what to do with the expert who is the only one who knows the subject but who does not come across well on camera. Many attempts have been made to substitute talent, to use parts of the expert's presentation and compensate with a heavy overlay of visuals, or to resort to actors. None of these methods has been found to be very successful.

Talent must be able to work under pressure. This entails flexibility concerning time constraints, equipment failures, staff personalities and unsatisfactory visuals.

EQUIPMENT

Two variations of the studio control room style are mobile units and permanently stationed equipment in large lecture rooms which is usually instructor-operated. Mobile units most often consist of a van that is completely outfitted as a studio with recording equipment and monitors and cameras for video work—both outdoors and in buildings not otherwise arranged for television. Some vans record on location with tapedecks; others transmit a signal via broadcast channels to the parent studio.

Lecture halls can be equipped with either single or multiple-camera arrangements. Sometimes tapedecks are connected so that this direct-teaching on television can be implemented at other times and places.

To facilitate viewing by the learners, multiple monitors are distributed throughout the main lecture hall. Sometimes other lecture halls are connected to the same facilities in order to expand the coverage of the television lesson.

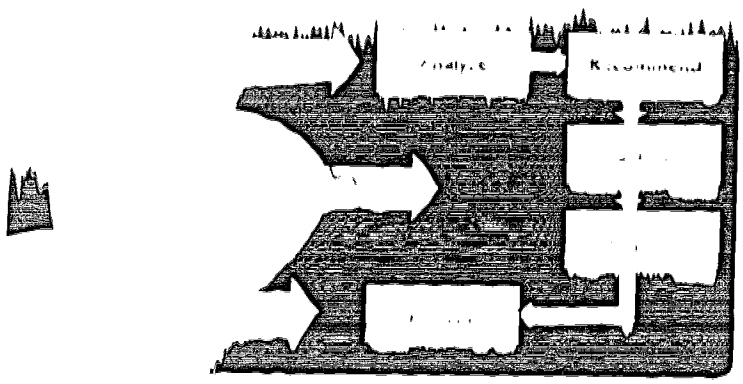
A fast-growing area is portable classroom television. The equipment is easily carried or moved around by carts and is available for use by both professional personnel and students in the educational system. The equipment for this type of television is being developed at a high rate and one of its main advantages is that it has been built for easy use. Both reel-to-reel and cassette video recorders are available at reasonable prices in black-and-white and in color. Special adjunctive devices are also available in portable styles to help improve the video product.

Battery operated television equipment is increasing in popularity, available in both black-and-white and color and has a great variety of applications. Minimal expertise is required for the operation of the equipment, therefore much experimentation and a resultant wide variety in quality [illegible] of this nature. Mishandling of equipment which [illegible] maintenance [illegible]. Portable equipment usually makes [illegible] point and at [illegible]

[illegible]

The Utilization Function

WILLIAM L KING, Miami University
[illegible] A HUFFMAN, JR Virginia Polytechnic [illegible]
WILLIAM B OGLESBY University of Iowa
RAYMOND WYMAN University of Massachusetts



Utilization Relationships

Functions

Selection of Instructional Materials The Educational Communications Consultant assists the faculty member in the identification of those materials which are appropriate to specific learning objectives

* Proper maintenance of materials is extremely important. D[illegible] materials are available. Responsibility for [illegible] should be assigned to a competent person.

- [illegible]
- [illegible]
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providing those materials and equipment items required by [illegible] tional [illegible] rain inherent within this responsibility. As the decentralization of audio-[illegible] ipment [illegible] materials to the learning environment is accomplished, it will be found

Central Storage

[illegible]

Distribution Procedures

[illegible]

Exar *of W* Distributes and [illegible] equipment [illegible] ed
[illegible] lized equipment as required; provid [illegible] location [illegible] ting of [illegible] ht (i.e.
bulb replac[illegible] etc.) as necessary; schedul[illegible] and maintains records of d[illegible]y [illegible]
Qualifi [illegible] maffe[illegible] ho[illegible] and [illegible] ment [illegible] equipment [illegible]
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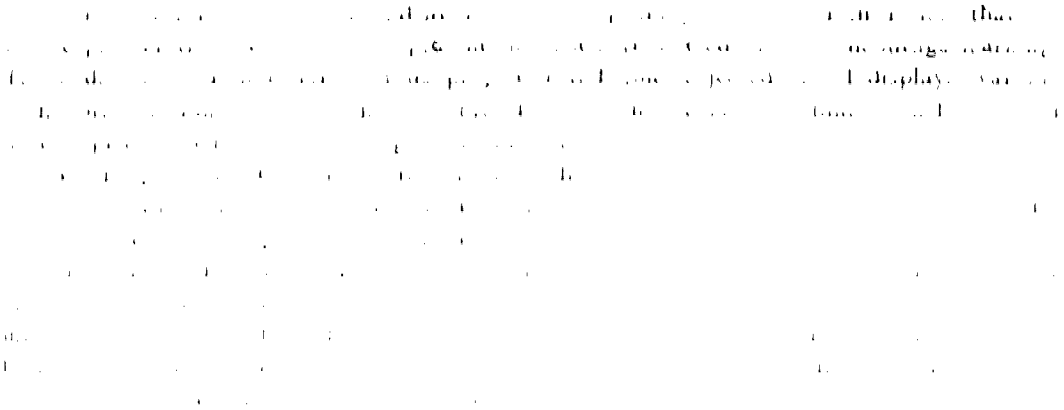
Facilities

Boston Univ.



own particular merits and, therefore, both are recommended for inclusion in a large group room display system. Ceiling recessed, electrically controlled, front projection screens are preferred to the manual, pull-down type and glass or plexiglass rear projection screens are preferred over the flexible vinyl type. The use of rear projection necessitates additional space for housing projectors and related equipment. If space is limited, special projection lenses and a "light folding" projection system using mirrors may be employed.

Climatic conditions, especially temperature factors involving cooling or air conditioning of spaces, are greatly influenced by projection media. Maintaining proper oxygen content in the air is a negligible problem, but cooling problems necessitate introducing larger volumes of air.

Heat is generated by light and electronic equipment at the rate of 3.4 BTU's per hour per watt.[4] Lamp wattage for various media range from 300 to 3000 watts or more, presenting a wide differential in the amount of heat added to a particular environment. Calibration of ventilation equipment to offset additional heat generated by projection is necessary.

Several kinds of ductwork systems and fans capable of quickly responding to increased heat loads are available. It is important to provide for adequate ventilation; failure to do so leads either to an uncomfortably warm environment or to an overburdened cooling system. Because ventilating systems are noisy, they should be located at some distance from the room they serve, lest they interfere with instruction. Sound absorbing material may have to be used to line ductwork to eliminate the noise.

Solid-state television projectors, monitors and receivers involve relatively few special problems for environmental design other than those already mentioned relating to light and glare factors which must be controlled.

Many types of instructional media produce noise which may hamper communication if not controlled. Unwanted sound produced by the media can be eliminated by isolation, in particular by enclosures for all projection equipment. Permanent booths can be installed in large group spaces for both front and rear projection. In addition, rigid, fixed, rear projection screens should be gasketed, since they are most susceptible to sound leakage. All projection areas should be lined with sound-proofing material and entrance and exit-ways should be solidly constructed and gasketed.

While sound identified as noise needs to be either absorbed or masked, other sounds—voice and audio program sources—very often need to be amplified to be audible. Electronically reproduced sounds are required in most learning spaces and provision should be made for their distribution.

A "centralized" sound system designed for use with all media and "tuned" to the room's frequencies is desirable. High-quality equipment with a reproduction range for full intelligibility and high tonal quality is most important. Such equipment must be housed and located to provide even distribution of volume and quality throughout the entire space with no feedback. Amplified live speech should appear to be coming from its source. Record and tape playing equipment, where necessary, ought to be within ready access and control of the instructor. Stereo sound systems might also be provided, should the room's activities necessitate the playback of stereophonic recordings. The use of a low level, distributed sound system is usually recommended only for rooms which have exceptionally low ceilings and a flat floor.

Small and Medium Group Space

The self contained classroom facility (22' x 30') accommodating 30-40 people (15-25 sq ft /student) remains a major component in the educational system today, although its

[4] Green, A. C. (ed.) *Educational Facilities with New Media*. Department of Audiovisual Instruction (now Association for Educational Communications and Technology), Washington, D.C., 1966, p. 119.

character is ever-changing due to varying kinds of experiences now taking place in education. In such a classroom the teacher may choose to incorporate overhead, slide, filmstrip and film projectors and videotape recorders and television receivers to enhance learning. Audiotape and phonograph recordings may also be an important aspect of his teaching. If a major adjustment in the room is necessary to accommodate such media, part of its value may be lost. Facilities ought to be designed for temporary and casual use of media equipment which can be stored and set up as needed with a minimal expenditure of time and energy.

Many problems of the large group space decrease in importance or disappear in small or medium rooms, but lighting control related to illumination levels and directionality and any resultant glare on screens, TV monitors and the like still have to be considered.

As with large group facilities, natural lighting still represents a liability to media projection and provision will have to be made for sufficient control of such lighting. Cable and conduit may be necessary to accommodate television monitors and special power sources for computer-based media. A ceiling and wall raceway system would serve to accommodate these services as well as the audio cable to serve motion picture speaker jacks at the front and back of the room.

Climate and temperature controls are important, but they do not present as much of a problem here as in large group spaces. The transmission of sound within the room and the isolation of sound from without can be provided in much the same way as in large rooms.

Flexibility of use dictates the exclusion in small and medium classrooms of such media-influenced large group design features as stepped floors. Economics usually excludes "special" air conditioning, and as mentioned earlier, remote controlled lighting, rear projection, sound amplification and special lighting fixtures. However, a degree of variable light control, even with standard fluorescent fixtures, is economically feasible by simply wiring the banks of lights in rows (widthwise) running from the front to back of the room. This way it is possible to simply turn off the front row of lights when the overhead projector or television monitors are being used. Similarly, the next row of lights can be turned off during slide and filmstrip viewing, leaving the last switch to turn off the last row of lights for opaque projection and motion picture projection. In this manner, ambient light levels may be maintained as high as possible for visual comfort and notetaking without compromising the quality of the projected image.

Individual Study Facilities

Independent study has become an integral part of education and, thus, of educational facilities planning. Within the school, individual study facilities should be liberally scattered throughout the building. If grouped in small clusters, several of them can share common rooms, services etc. Their requirements on the physical plant, such as lighting, acoustics, climate and engineering factors, can be more efficiently and economically provided when arranged in clusters. They should be located throughout the school in special project rooms, with classrooms, between classrooms and in resource areas.

The individual study unit may be an enclosed or semi-enclosed carrel, room, cubicle or any other facility designed especially for such purposes. Whatever their basic form, these learning facilities should be designed as independent bits of space which will appease the student's sense of territoriality and minimize external environmental distractions.

The carrels may be of the traditional "dry" variety, wherein there is no provision for electronic resources; they may be "wet" stations containing specific built in or portable independent study equipment (tape recorder, microfiche readers, teaching machines), or they may be "wet" carrels, connected to school-wide audio, audiovisual or computer networks (dial access and computer assisted instruction). Generally, combinations and variations of

these units are considered desirable to cater to individual preference and to handle various tasks economically. Carrels with listening and recording capability, of the type used in language laboratories, require special ancillary equipment such as teacher consoles, monitoring facilities and tape recording storage. Special provision must be made for conduit from the teacher's console to floor boxes throughout the center.

Quantity and quality of lighting varies with the particular task going on in such facilities, but overall illumination should be diffuse and shadow-free with emphasis given to local lighting of work surfaces. Acoustical problems can be solved through the use of headphones. Some areas, such as those used for recording, must be kept relatively free from intruding noise. Distraction (noise, unnecessary traffic, glare and drafts) should be designed out of such areas. Air exchange must be frequent and temperature and humidity kept within acceptable ranges. Good ventilation and appropriate temperature and humidity levels should be maintained.

Where computers are used, cabling with an elevated floor is essential. The computer room, if there is one, should have a strictly controlled, dust-free environment which has been acoustically treated to prevent noise transmission.

Independent study carrels are often used as the terminals for computer-assisted instruction (C.A.I.) and, in such cases, need to be equipped with devices such as tele-typewriter, page printer, screen (cathode ray tube), electronic light pen, image projectors, tape playback, earphones, speakers and so forth. The terminals may be connected to a computer at some centrally located site other than the school building itself. If this is the case, high-speed telephone lines are used for the hook-up from central processor to regional line concentrators which direct and control messages between central processors and terminals. Telephone lines must be installed to transmit signals from terminals to so-called regional sites in the building and vice versa. These are relatively easily accommodated within existing facilities.

Space requirements for C.A.I. include terminal station space, machine area for on-site equipment, maintenance service area, storage areas for magnetic tape, cards, etc., and central site space. Information on C.A.I. needs is readily available in the literature.[1] If the C.A.I. originates within the school, it is more efficient to locate it near the source of power and air conditioning. For economic reasons, the units should be placed near shipping and storage facilities. C.A.I. equipment use creates a demand on the air conditioning system far in excess of that needed for normal instruction areas. This entails enlarged ductwork mixing boxes and diffusers and may even require additional ceiling space.

The cabling requirements between terminals and central or local control units are regarded as the most restrictive elements of C.A.I. Specific requirements are detailed in *Instructional Hardware, A Guide to Architectural Requirement*, as are outlines of various systems of routing wire and cable between computer system components. Floor trench, raised floor, cable ramp, underfloor raceway, cellular floor, ceiling space, wall raceway. The use of any of these is dependent on the existing facilities and/or economic factors.

A typical computer system requires electrical power that is generally available in most buildings (120 or 208 volts ± 10%, frequency 60 Hz), with general requirements of 0.5-1.0 KW for each student station, 1.0-5.0 KW for control or communication unit and 6.0-20 KW for the central computer room. However, the overall electrical power distribution system must provide for the additional demand on the [illegible] air conditioning system and for the probability of maximum use of all [illegible]

[1] [illegible] *Instructional Hardware, A Guide to Architectural Requirements*, Educational Facilities Laboratories, New York, 1970, pp. 63-98.

Equipment

Television

Television is one electronic device which can be used successfully in all major instructional settings: large (assuming the availability of a TV projector of acceptable quality), medium and small group and independent carrels.

Coaxial cable between studio and control and distribution centers for a "closed," "in-house" TV system may be easily accommodated by false floors, false ceilings and walls with accessible spaces for cabling all areas where equipment terminates. Major vertical runways for cables between floors and a horizontal network of cable-ways would provide building distribution. The use of microwave transmission systems should be considered when distribution is required over relatively long distances.

Television production has specific engineering requirements which are competently discussed in a number of readily available publications. A very thorough treatment of its lighting requirements is presented in the *IES Lighting Handbook*.*

The use of television in the classroom as a display device requires very little in the way of environmental modification. Its image brightness is such that it requires no special darkening procedures unless it is located right next to a luminaire, in which case the individual luminaire can be wired to turn off automatically when the TV monitor is turned on. Care should be taken that the monitor is not mounted directly against a common wall or it will transmit noise in the form of vibration to the adjacent classroom.

Dial Access

Typical devices for dial access equipment include dial, touchtone or keyboard controls for selection; earphones or speaker for listening; teacher-call, microphones or intercom phone for responding; tape recorder and/or controls for recording; TV screen for viewing; and on-off volume control switches.

Space requirements relate to two areas, user location and information storage and control areas. User location refers to the typical carrel. Information storage and control areas should be located as close to dial access stations as possible so that telephone lines and coaxial cable can be kept as short as possible. Dial access stations are usually located in the materials resource center, specialized media classrooms and in selected independent study facilities.

Multi-Facilities

A multi-communications system, which provides for audio and video information between and among all classrooms, offices and studios of the school, certainly enhances the use of media in the school plant. Clocks, telephones, intercom, microphone and television jack, light controls and temperature controls can all be interrelated with such a system and become an integral part of the media system of the school.

Centralized Media Centers

In *Creative Planning of Educational Facilities*, Basil Castaldi discusses in detail the concept of the Library Communications Center. He states "... there is a unity in the media of all communication and the library is strategically equipped to provide the unifying vehicle."

Castaldi goes on to explain this concept and cites a plan developed by Louis G. Vagianos, University Librarian, Brown University, of a facility capable of serving an enrollment

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Kaufman, John E. (Ed.) *IES Lighting Handbook*. Fourth Edition. 1966.
Castaldi, Basil. *Creative Planning of Educational Facilities*. Rand-McNally, 1965.

of 6,000 students and 300 faculty. Table 1 shows the space allocation for the various functions housed in this building. It will be noted that the center includes, along with the standard library-associated spaces, other media-oriented areas such as: the copy room, an instructional materials production area and work room, self-instructional carrels, listening rooms, an office for the audio-visual librarian, a set of conference rooms, a television studio and production center and a computer laboratory.

Such a concept and spatial commitment deserves the consideration of any college or university unit of similar size. However, this writer believes that a number of specialized presentation rooms and support areas should be added to make optimum use of this plan. These would include a presentation complex consisting of four different presentation environments: a large group presentation room, a medium-large group presentation room, a flexible presentation room for small and medium sized groups, and a conference presentation room. Each room would be designed for extensive media use and characterized by an architectural design appropriate for the group size and proposed social interaction and communication pattern.

All four of these multimedia presentation rooms would be physically linked to a central rear-projection area. The largest presentation room would also be equipped with a front projection booth. The rear projection facility would be functionally linked to a program preparation room where instructional materials produced or collected specifically for use in the presentation space could be stored, set up and previewed before use. The preferred location for this room would be directly above or below the rear projection room, accessible by a freight elevator. Additional components of this preparation room would include a photographic darkroom, an electronics and mechanical repair shop and a set of offices for the presentation coordinator and his staff.

TECHNICAL AND ENVIRONMENTAL CONSIDERATIONS

Basic Technical Data: Projection Systems

Types of Projection Systems

There are two main types of screens used in conventional projection systems: rear projection screens (RP) and front projection screens (FP). Some basic advantages and disadvantages of the two types are shown in Table 2. Within these two major categories there are a number that have distinct gain and distribution characteristics which affect their appropriateness for different facilities.

FP Screens

1) *Matte White Screen* angular coverage: 100° +
Low gain (85%), fixed screens available in stretch vinyl; roll-down type available in flame resistant cloth. The pull-down type is recommended for all types of projection in standard size classrooms. The electric roll-down type is recommended for large group presentation rooms and auditoria, particularly in situations where high light output projection equipment is available.

2) *Beaded Screen* angular coverage: 40-50°
High gain (600% for early models, 300% for current microbead models) at 0°, low gain (80%) at 20° bend angle; requires totally darkened room for most kinds of projection. Recommended for long, narrow, large-group presentation rooms where standard projection equipment is used to produce images greater than 10 feet in width.

3) *Lenticular Screen* angular coverage: 90° horizontally and 25° vertically. Moderately high gain (180%) at 0° and 80% at a 50° bend angle. Available up to 70" x 70" in tripod or wall units for small classrooms. Larger sizes available only for fixed installations. The pearl white version is recommended for movie theatres or large-group spaces where a fixed projection screen is possible. Silver and black lenticular materials are available for special purpose use.

Table 1
Space Allocation for a Library Communications Center*

Function of Space Allocation		*Suggested Net Area*
1. Book collection: 400,000 volumes @ 15 volumes/sq. ft.		26,667
2. Space for Reading: 1,250 @ 30 sq. ft./reader		37,500
3. Administration: 1 office @ 250 sq. ft. (Librarian)		1,200
1 office @ 225 sq. ft. (Assistant Librarian)		
1 office @ 225 sq. ft. (Secretary)		
1 Conference Room @ 500 sq. ft.		
Initially 3 staff with no student assistants		
4. Technical Processes: 2 offices @ 200 sq. ft. (one for Head Cataloger, one for Head Order Librarian)		5,000
Initially 8 staff plus 10 student assistants		
5. Circulation Department: 1 office @ 200 sq. ft. (Circulation Librarian)		5,000
1 workroom @ 2,000 sq. ft.		
1 Reserve Book Room @ 2,800 sq. ft. (seating for 150 students at tables or carrels)		
Initially 6 staff plus 20 student assistants		
6. Public Services: 1 office @ 200 sq. ft. (Reference Librarian)		6,600
1 workroom @ 800 sq. ft.		
Initially 6 staff plus 5 student assistants		
Seating for 100 students at tables or carrels should be provided in this area.		
7. Public Catalog		1,500
8. Staff Lounge		1,000
9. Faculty Studies: 50 studies @ 90 sq. ft.		4,500
10. Map Room		500
11. Copy Room		500
12. Instructional Materials Production Area and Workroom	1,200	
Self-instructional		
Microtext cubicles 100 @ 30 sq. ft. person	3,000	
Listening Rooms		
1 office @ 200 sq. ft. (Audiovisual Librarian)	200	
1 storage area @ 500	500	
		4,900
Initially 2 staff plus 10 student assistants		
13. Conference Rooms: 3 @ 250 sq. ft.—cap. 10		2,850
3 @ 300 sq. ft.—cap. 12		
3 @ 400 sq. ft.—cap. 16		
14. Television Studio and Production: 1 office @ 200 sq. ft. (Supervisor)		3,000
Initially 2 staff plus 5 student assistants		200
15. Computer Laboratory: 1 office @ 200 sq. ft.		2,500
Initially 2 staff.		200
16. Receiving		1,000
Initially 1 staff		
17. General Storage		1,000
TOTAL NET AREA		105,617

*From Castaldi, Basil. *Educational Facilities*. Allyn and Bacon, Inc., 1967, p. 455.

Table 2
Comparison of Front and Rear Screen Projection for Various Considerations*

CONSIDERATION	FRONT PROJECTION	REAR PROJECTION
	(Projected to opaque screen from viewing side of screen)	(Projected to translucent screen from side of screen away from audience)
Proximity of Lecturer to equipment	REMOTE – without equipment attendance or automation – requires lecturer to go through audience to tend equipment.	CLOSE – with or without equipment attendance or automation – lecturer in close to equipment for tending.
Method for providing central attendance	Racetrack continuous projection booth over perimeter corridor	Central projection area (requires additional building space)
Programming	Requires careful programming	Simpler programming, less wiring
Emergency tending	Emergency tending difficult unless signal system provided	Emergency tending good. Care must be taken to prevent attendant from crossing other projections
Screen and seating	High gains through wide angles permit greater seating	Viewing side angle not as great for same values of gain
Projection distance	Projection over audience may be slightly distracting	Accomplished at sacrifice of space, and light intensity if mirrors are used
Noise	Noisy if equipment is in room. Absolutely quiet if equipment is in booth.	Some machine noise will penetrate screens
Tending of Equipment	Distracting and noisy if in viewing room. Not noticed or heard if in booth.	Some noise may be heard through screen. Movement behind screen may be distracting
Projector light as source of incident light on screen	Undesirable in room. Non-existent from projection booth.	Causes some incident screen light. Requires dark-colored, light-absorbing paint and shielding in room area back of screen.
Overhead Projector	Conspicuous in room. Lecturer in central position. Attendant optional	Equipment not conspicuous. Lecturer not in room. No attendant required.
TV Projector Application	Conspicuous	Inconspicuous
Interpositioning	Front screens not usable for rear screen projection	Rear screens may be used for front projector with some sacrifice of transmission and gain.

*Taken from *Space for Audio-Visual Large Group Instruction*, UFRC, Madison, Wisconsin, 1963.

4) *Aluminum Foil Screen*—Angular coverage 50° horizontally and 20° vertically. Extremely high gain (1700%) at 0°, but rapid fall off beyond 20° each side of projection axis. Delicate surface and relatively small size (maximum standard size 40" x 40", slightly larger size available on special order) makes it less suitable than the roll-down matte white or the lenticular for standard classrooms. Its high gain and ability to reject stray light make it particularly suitable for small-group work in spaces where room lighting is very high.

Rear Projection Screens

A commercially produced RP screen consists of a base and a microlens coating. There are three general types of bases used: glass, plexiglass and flexible vinyl. These rank in the same order in superiority of performance and cost.

RP screens, like FP screens, come with different gains and angular coverage. A low gain (120% at 0°) RP screen is recommended for rooms with wide viewing sectors (over 70°) and a moderately high gain screen (250% at 0°) is recommended for narrower viewing sectors, particularly in cases where standard projection equipment is used. A high gain (1400% at 0°) screen is not recommended for conventional educational use, since it is characterized by an objectional "hot spot" during projection. There are also RP screens which have been designed for both front and rear projection, but like the high gain screen, they are recommended for special projection purposes only.

Recommendation

For greatest versatility in specialized medium and large-group presentation rooms, both FP and RP systems should be installed. The author's first choice for an FP screen would be an electrically controlled, matte-white screen. For rear projection, a 3/8" to 1/2" glass RP screen with a gain of between 250% and 300% should be selected for relatively narrow, large-group viewing areas. A glass fenscreen, with a gain ranging between 120% and 180%, should be used for rooms having a relatively wide viewing area (greater than 70°).

Projector-Screen Relationships

Four factors which determine the location of projectors and/or the appropriate lenses for a fixed facility are:

- Width (in inches) of the film frame being projected (a)
- Focal length (in inches) of the projection lens (L)
- Projection throw in feet (d)
- Width (in feet) of the image on the screen (s)

The relationship between these factors is well enough expressed, for most purposes, by the formula $S = \frac{da}{L}$. We can use this formula to determine any one of the four variables if the other three are known (see Table 3). For the reader who does not wish to use the formula, it should be noted that the *NAVA Audio-Visual Equipment Directory*[1], in addition to its comprehensive listing of commercially available "hardware", also provides a series of charts to assist the media specialist in the selection of appropriate lenses for given projection distances and image sizes.

Once the width of the screen image is known, its height can easily be calculated by applying the width to height ratio for the particular film or slide being projected (see Table 3).

[1] *NAVA The Audio-Visual Equipment Directory*, 20th Edition, 1974. Fairfax, Va.

Table 3
Aperture Measurements of Different Projection Media

Film	Aperture Width (in inches)	Aperture Height (in inches)	w/h ratio	(approx.)
Reg 8mm	0.172	0.129	1.333	(4 to 3)
Super 8mm	0.211	0.158	1.335	(4 to 3)
16mm movie (standard)	0.380	0.284	1.338	(4 to 3)
Instamatic	1.043	1.043	1.000	(square)
35mm (single frame) filmstrips	0.860	0.650	1.323	(4 to 3)
35mm (double frame) slides	1.344	0.906	1.483	(3 to 2)
35mm movie (standard)	0.825	0.600	1.375	(2-3/4 to 2)
2x2 (super-slides)	1.500	1.500	1.000	(square)
2-1/4 x 2-1/4 slides	2.188	2.188	1.000	(square)
3-1/4 x 4 slides	4.000	3.250	1.230	(5 to 4)
Overhead projection	10.000	10.000	1.000	(square)

Determining Projector Brightness

Table 4 shows the recommended screen brightnesses for different projected images. Screen brightness is primarily the result of two factors: projector luminance and screen gain.

A simple way to determine the required light output for a proposed projection system is to take the area of your projection surface (in square feet), divide it by the screen gain, and then multiply this by the recommended screen brightness (in foot lamberts) for the particular medium under consideration (as shown in Table 4). This will give you an acceptable approximation of the required projector light output in screen lumens. A more comprehensive method of determining this is provided in the literature.[9]

Today the problem of setting up a projection system has been facilitated by the fact that most projector manufacturers will provide such information in their technical specifications and that there is a wide range of projection equipment available to meet special operator needs and performance requirements. In general, projectors should be chosen on the basis of how well they measure up when evaluated on the following points: availability, acquisition cost, maintenance cost, ease of operation, ease of maintenance cost, dependability, light output, resolution, color capability, sound fidelity, sound volume, appropriate lenses, noise and heat production, remote control capability and compatibility of components

Basic Environmental Data

Visual Learning Environment

Viewing Distance and Screen Size

It is impossible to identify with complete confidence any one image size-viewing distance relationship as the best for all display purposes. Most media specialists recommend a minimum viewing distance of two times the screen width (2W) and a maximum viewing distance of six times the screen width (6W)

[9] Bretz, Rudy and McVey, G.F. "A Nontechnical, Nonmathematical Approach to AV Planning: AV Beyond Basics." *Educational Instructional Broadcast*, Sept., 1970, pp. 12-26.

Table 4
Recommended Screen Brightnesses for Different Projected Images*

Motion Pictures

**5 ft. L.: Minimum (Marginal for some observers)
10 ft. L.: Satisfactory
15 ft. L.: Excellent
20 ft. L.: Maximum (flicker threshold for some observers)

Slides:

1 ft. L.: difficult to distinguish color from black and white
**2.5 ft. L.: minimum for gross images
5 ft. L.: minimum for slides with detail
10 ft. L.: satisfactory
20 ft. L.: excellent

(Theoretically, the upper limit for slides is the tolerance limit of the eye. For practical purposes, economics and projector limitations will control)

Projected TV:

**2 ft. L.: Gross black and white images
20 ft. L.: Maximum, flicker threshold

TV Monitors:

100 lumens per sq. ft.

*American Standards Association (A.S.A.) standards
**Added by Caravaty and Winslow (1964) who tested A.S.A. standards and modified them for classroom use.

While guidelines work well for conventional film-based media viewing, their application to special viewing situations will not produce optimum results. For example, they do not apply to multi-image or television display, nor do they work for the unfortunate, yet almost universal situation, where instructors do not observe recommended legibility standards, i.e., producing overhead projectuals from standard typed originals on 8 1/2" x 11" paper stock using a fast copy transparency maker.

Because of this, the author has developed for the reader a table showing different viewer-display distances and their visual correlates. This table attempts to reflect the perceptual, viewing comfort and legibility factors inherent in special viewer-display events and, hopefully, will help the facility planner in selecting a screen size appropriate for his particular situation (see Table 5).

Viewing Angle

Whenever a person is required to view a display from an angle deviating considerably from the perpendicular (direct line of sight), losses either in viewing accuracy or visual comfort occur. Figures 1 and 2 show this, as well as other display-viewer distance considerations. These drawings will help the media specialist and school planner determine the length, width and inclination of the viewing area in a large-group classroom or auditorium.

In this type of room, the bottom of the projection screen should be at least 4 feet, but not more than 6 feet, from the floor. In a standard classroom, the bottom of the projection screen should be 3 feet from the floor when the seating arrangement provides each student with an unobstructed view. It should be 4 feet from the floor when seating is arranged in conventional rows. The screen should be mounted about two feet from the wall so that it can be pulled back at the bottom to minimize keystoning.

Table 5
Viewer Display Distance Recommendation

Screen-Viewer Distance Ratio	Visual Correlate
1W	Recommended minimum distance for multiscreen viewing.
1.3W	Distance where projected scene has same perspective as camera which recorded the scene. Recommended distance for media presentation which attempts to simulate realism.
2W	Cone of regard wherein 70% of total acuity takes place. Recommended minimum distance for most media viewing where comfort and visual detection are primary concerns.
3W	Recommended maximum viewing distance for multiscreen viewing.
4W	80% total acuity. Recommended minimum distance for television viewing or other low resolution display systems. Recommended maximum viewing distance for displays having exceptionally small symbols, i.e., overhead projection of transparencies produced 1:1 from standard typed copy.
6W	Recommended maximum distance for viewing most media particularly commercially produced motion pictures. At this distance eye fixations are evenly dispersed throughout display area.
10W	Recommended "ideal" maximum distance for viewing television.
14W	"Traditional" maximum distance for viewing television.
20W	Distance which allows whole display to fall on most sensitive part of retina – highest level of acuity. Recommended maximum size for important features contained in a visual display.

Illumination

The optimum illuminated environment is one which results from the effective coordination of lighting quantity and quality as well as directionality in keeping with surface colors and reflectivity. The following explains the various components of illumination and some basic recommendations:

Illumination level General classroom activities: 30-50 foot candles critical visual tasks (art work, etc.): 100 foot candles audiovisual activities, variable from 0-30 foot candles; dimmer controls either AC variac or silicon-controlled rectifiers (SCR) type (grounded independently to avoid interference with audio systems).

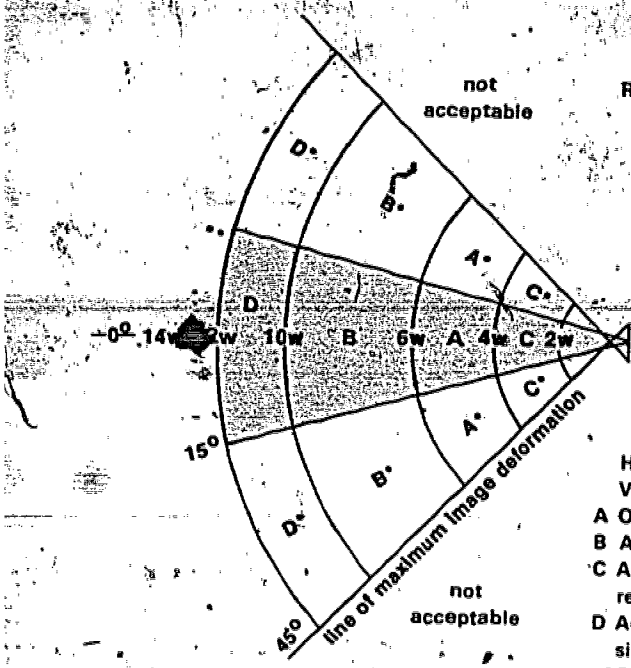
Reflectances Desk tops: matte finish, 30-50% reflectance; floors: natural woods or light colored tile or carpet, 30-50% reflectance; chalkboards: green, not to exceed 20% reflectance grey of black, not to exceed 10% reflectance; walls: matte finish, 40-60% reflectance; ceiling: matte finish, 70-90% reflectance.

Brightness Contrasts (BCR) General recommendations: The BCR of large adjoining areas should fall somewhere between 1:1 and 3:1 ratio, with the task area being brighter than its surroundings; for small adjoining areas under low light levels, the acceptable BCR will range between 3:1 and 10:1.

Glare Most glare in the classroom can be eliminated or reduced by the following methods: providing shades or drapery for all classroom windows which have outside exposure (solar shield also desirable); equipping fixtures with some directional or diffusing device; locating all luminaires so that their major light transmission does not fall within the

Figure 1

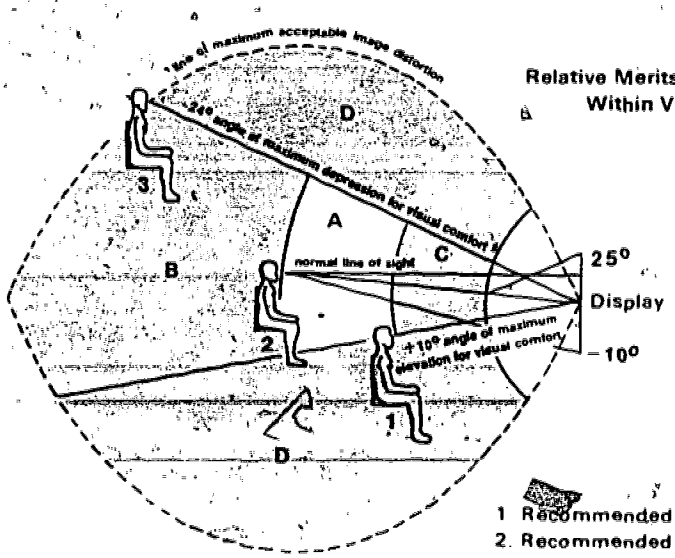
Relative Merits of Different Viewing Locations Within Horizontal Viewing Sector (1)



Horizontal Viewing Sector
A Optimum
B Acceptable
C Acceptable for high resolution systems
D Acceptable when symbol size is adequate
* Requires compensatory head movements which promote fatigue
** Fan-shaped viewing sector based upon adjustments in angular viewing distances from 0°

Figure 2

Relative Merits of Different Viewing Locations Within Vertical Viewing Sector (1)



Vertical Viewing Sector
A Optimum
B Acceptable
C Acceptable for high resolution systems
D Acceptable, but with high fatigue factor

1 Recommended max viewing angle-front row.
2. Recommended max viewing angle-rear row.
3. Not recommended for media viewing but acceptable for science and medical demonstration rooms

zone measured 45° above the student's line of sight; and avoiding having glossy or specular surfaces in the classroom.

Flicker—All light sources which produce a noticeable and discomforting flicker should be either modified or eliminated from the classroom. Typical sources of flicker include: excessively bright luminaires, excessively bright motion picture projection, defective lamps, the ends of fluorescent lamps, excessively bright television picture tubes and strobe lights.

Color Rendition—Since all types of illumination reproduce colors differently, luminaires (incandescent or fluorescent) should be chosen on the basis of their color appearance and color rendering qualities. Recommendation: incandescent "on" dimmers for low-light levels used in specialized media presentation rooms; cool white or warm white fluorescent for general classroom lighting; deluxe warm white fluorescent for reception areas where natural-looking skin tones are desired; General Electric Chroma 50 or Chroma 75 (or equivalent) for special graphic and visual arts rooms.

Fluorescent or Incandescent Lights—Since the research indicates that one can expect relatively little difference in visual acuity and comfort with either fluorescent or incandescent lights, the selection of lighting systems should be based on factors other than visual performance. Some recommendations follow: use incandescents when variable intensities and directional control are needed; use fluorescents when illumination levels exceeding 50 foot candles are desired; use fluorescents when long life and low heat gain are required.

Color—When used properly and combined with the right kind of illumination, color can be an effective tool for the school designer and classroom teacher. Both as a surface treatment and as an illuminant, color has relatively predictable behavioral concomitants. Different colors evoke different physiological arousal levels and attitudinal responses and produce different psychospatial effects, which can be used effectively by the school designer in his treatment of the school interior and by the classroom teacher in the arrangement of displays and modification of the school's work and study environment.

Therefore, it is recommended that: rooms to be action-oriented should be decorated in 'tints' of the warmer colors (yellow, orange, red) and those planned for quiet activities in 'tints' of the cooler colors (green, blue).*

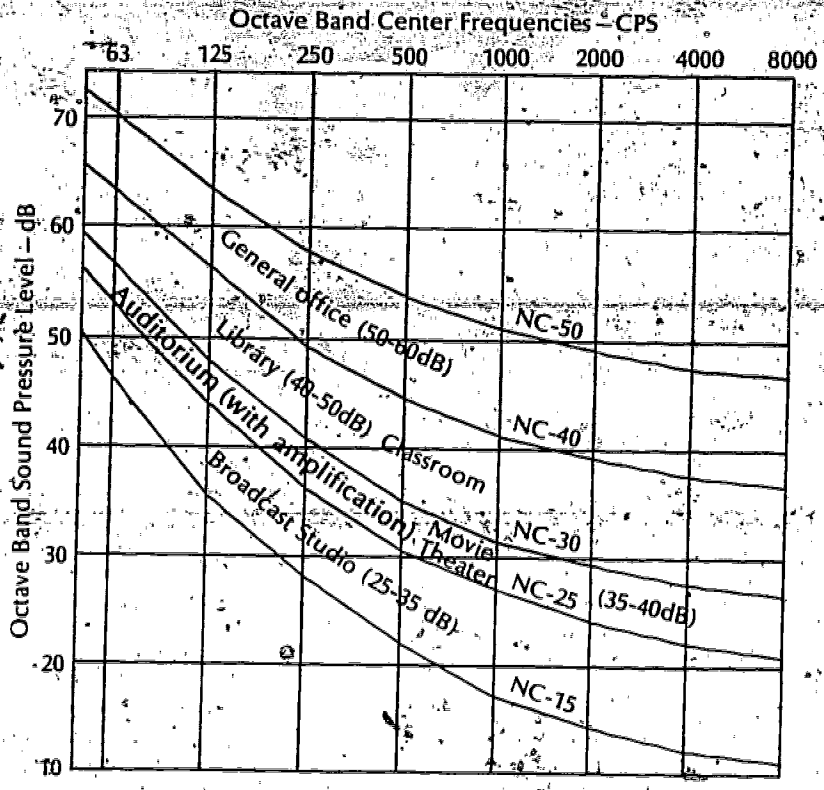
Bold, fully saturated colors, particularly reds and blues, should be avoided for general wall treatment, especially on surfaces which may be used as backgrounds for visual displays.

The Acoustical Learning Environment

Easy audibility depends greatly on the difference between the level of informational sound and the level of background noise (signal to noise ratio). The minimum acceptable signal to noise ratio is 10 dB. Since normal speech generally registers 60 dB, it stands to reason that the background noise level (in the speech frequencies) should remain well below 50 dB. A totally quiet room is also not recommended; a certain amount of background noise is necessary to mask the non-informational sounds created by classroom activities, i.e., writing, page turning, etc. Background noise levels recommended for different types of rooms are shown in Figure 3.

The surfaces of a room give it its sonic character. A room containing mostly sound-reflecting surfaces will tend to have a longer reverberation time than a room of the same volume containing mostly sound-absorbent materials. A room's reverberation time affects the intelligibility and aesthetics of the sounds produced in and [illegible] the type of audio activities appropriate to [illegible] Figure 4.

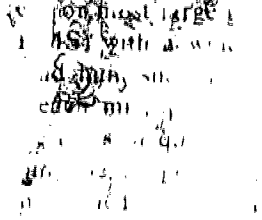
*The word 'tints' is used to emphasize a desaturated color.

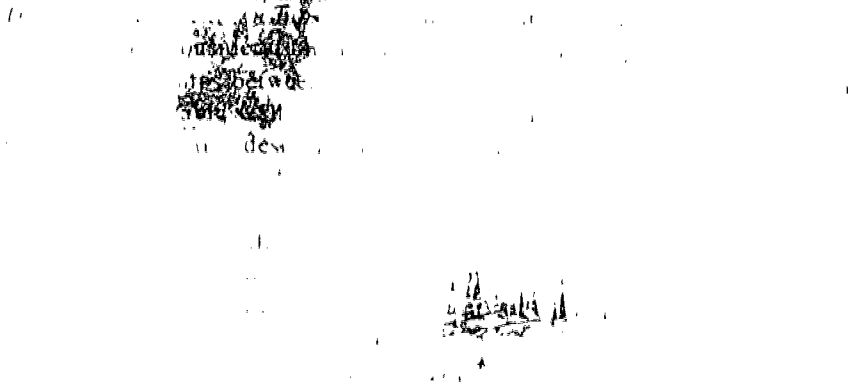


RECOMMENDED NOISE CRITERIA FOR ROOMS
Shown by NC Curves and Average dB Level
Figure 3

ACTIVITIES AND RECOMMENDED REVERBERATION TIMES	
Speech recording and broadcast	0.4 – 0.6 seconds
Elementary classrooms	0.5 – 0.9 seconds
Motion picture presentation	0.6 – 1.2 seconds
Lectures and other activities using sound amplification	0.6 – 1.2 seconds
Musical comedy	1.0 – 1.4 seconds
Drama	1.0 – 1.4 seconds
Opera	1.2 – 1.6 seconds
Piano recital	1.2 – 1.6 seconds
Voice and violin recital, string quartet, chamber orchestra	1.4 – 1.8 seconds
Symphony orchestra (contemporary works)	1.3 – 1.6 seconds
Symphony orchestra (Brahms, Wagner)	1.8 – 2.0 seconds
Liturgical choral music, organ	1.8 – 3.0 seconds
Medieval liturgical works	4.0 – 8.0 seconds

Figure 4





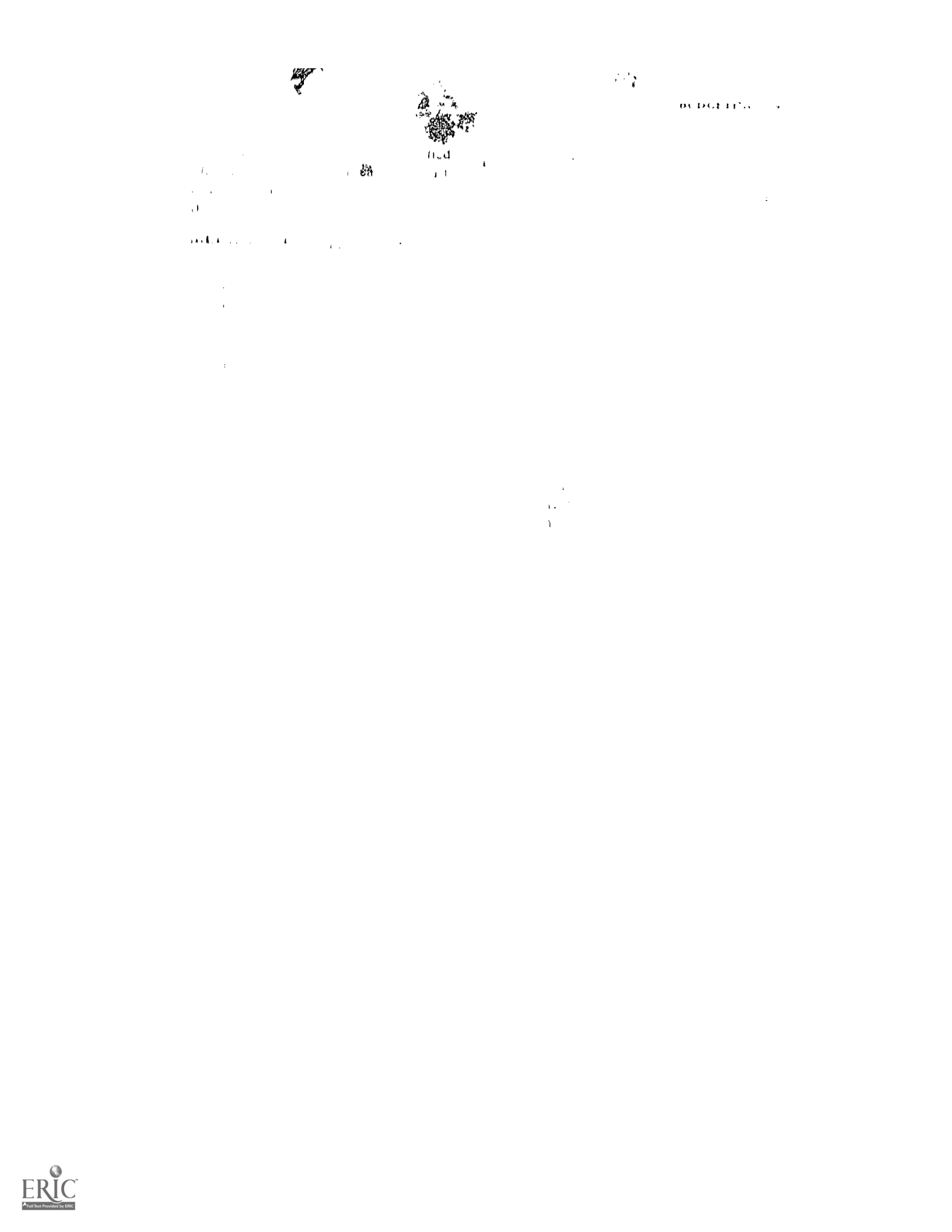
Budgeting for Learning Resources Programs

ALDEN BROOKS, Washington State U.


aterials

Program planning budgetary system

- The central university [illegible] office and departments [illegible] performance [illegible] data [illegible] future [illegible]



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